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GREAT LAKES FORESTRY CENTRE
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Results of forest insect and disease surveys in the ALGONQUIN REGION of Ontario, 1986

CARRIED OUT BY THE GREAT LAKES FORESTRY CENTRE IN COOPERATION WITH THE ONTARIO MINISTRY OF NATURAL RESOURCES

R. J. Sajan and B. E. Smith
Miscellaneous Report No. 52

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THE GREAT LAKES FORESTRY CENTRE

The Great Lakes Forestry Centre is one of six regional centres located across Canada and operated by the Canadian Forestry Service. The Service provides federal leadership and a national focus in the forestry sector for the continuing economic, social and environmental benefit of Canadians. The Centre conducts two major programs: research and technical services, and forestry development. Both programs address major problems affecting forest management and the forested environment in Ontario. Because of the transprovincial nature of the forest resource, many elements of the research program are of national significance.

For many years the research program was guided by the Canada-Ontario Joint Forestry Research Committee, made up of senior members of the Centre and the Ontario Ministry of Natural Resources. Responsibilities for coordinating all forestry research in Ontario have now been assumed by the Ontario Forestry Research Committee, which has representatives from forest industry, universities and federal and provincial governments. This Committee also ensures that research results are transmitted to forest managers.

Staff of the forestry development program negotiate and administer federal-provincial cost-sharing agreements with the province of Ontario, conduct economic studies, and assist in implementing job creation programs in the forest sector. This requires close cooperation with the Ontario Ministry of Natural Resources and with other provincial and federal agencies concerned with the forest sector.

The Centre recognizes that forested land must be managed in the best public interest, not only for the wood production essential to our economy but also for the recreational purposes that are so important to our social well-being. These goals must be achieved in a manner that will maintain or improve the quality of the forest environment and preserve it for generations to come.

RESULTS OF FOREST INSECT AND DISEASE SURVEYS IN THE ALGONQUIN REGION OF ONTARIO, 1986

(FOREST DISTRICTS: PARRY SOUND, BRACEBRIDGE, ALGONQUIN PARK, PEMBROKE, MINDEN AND BANCROFT)

R.J. SAJAN and B.E. SMITH

GREAT LAKES FORESTRY CENTRE

CANADIAN FORESTRY SERVICE

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SURVEY HIGHLIGHTS

This report deals with the most important and prevalent insect and disease conditions that were detected during extensive aerial and ground surveys throughout the Algonquin Region of Ontario in 1986.

Gypsy moth larvae caused severe defoliation across some 376 ha in the Bancroft and Pembroke districts and the forest tent caterpillar caused similar levels of damage totalling some 11,160 ha in three separate areas of the Parry Sound District. The Bruce spanworm caused moderate-to-severe defoliation of sugar maples, scattered throughout some 172,000 ha in the Minden and Bancroft districts. This season saw an 85% reduction in the area heavily infested by the jack pine budworm in the Parry Sound District, and sampling data indicate a complete collapse in 1987.

Three additional red pine plantations were found to be infected with the European race of Scleroderris canker, the areas all being adjacent to sites sanitized in 1985. One area was detected in McMurrich Township in the Parry Sound District, and two in Mayo Township in the Bancroft District. The cold temperatures experienced in early May and June caused heavy frost damage to a wide variety of tree species and the unusually wet summer resulted in a very high incidence of hardwood leaf diseases.

Special surveys included the inspection of 10 randomly selected eastern white pine plantations, and a collection of 100 semimature eastern white pine cones from two locations in the region. The red oak plots were retallied and an additional ARNEWS plots was established in an oak stand in Sproule Township in Algonquin Park District, bringing the total in the region to six permanent monitoring plots.

In this report, the following categories are used to determine the importance of insects and diseases:

Major Insects/Disease

capable of causing serious injury to or death of living trees or shrubs

Minor Insects/Diseases

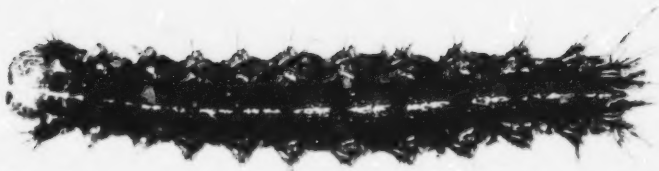
capable of causing sporadic or localized injury but not usually a serious threat to living trees or shrubs

Other Forest Insects/Diseases (Tables)

These tables provide information on two types of pest:

(1) those which are of minor importance and have not been known to cause serious damage to forest trees,

Frontispiece



Mature gypsy moth, *Lymantria dispar* (L.), larva

Mature forest tent caterpillar, *Malacosoma disstria* Hbn., larva

(2) those which are capable of causing serious damage but, because of low populations or for other reasons, did not cause serious damage in 1986.

The authors would like to express their appreciation to personnel of the various Ontario Ministry of Natural Resources (OMNR) district and regional offices, wood-using industries and private individuals for their excellent cooperation during the 1986 field season.

R.J. Sajan

B.E. Smith

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INSECTS

Major Insects

Pine False Webworm, *Acantholyda erythrocephala* (L.)

The pine false webworm continues to spread across the region since it was first detected in the Bancroft District in 1972. Damaging population levels were detected this season in a red pine (*Pinus resinosa* Ait.) plantation at the south end of McMurrich Township, Parry Sound District, which is currently the northernmost point of known distribution of the pest in the region. In this 18-ha red pine plantation, 60% of the 3-m-high trees were infested, with an average of five webmasses per tree, and the resulting defoliation averaged 10%. The highest population was detected in a 6-ha red pine plantation in Stanhope Township in the Minden District. A standard 15-tree pest evaluation revealed that 68% of the 2-m trees were infested with an average of six webmasses per tree, and the resulting defoliation averaged 25%.

This introduced pest was evaluated at a total of 10 locations across the region, and at the majority of the locations only 1 or 2% of the trees were found infested. These data are summarized and presented in Table 1.

Saratoga Spittlebug, *Aphrophora saratogensis* (Fitch)

The area containing damage caused by the Saratoga spittlebug continued to increase at three known distribution points in the Pembroke District. Nymph counts, conducted in May and June, at the base of the alternate host, sweetfern (*Comptonia peregrina* [L.] Coult.) revealed an average of two nymphs per stem in the infested areas. These nymph counts were similar to those reported for the last three years.

In Hagarty Township, an expansion of 0.5 ha has taken place in the existing 3 ha of mortality that are scattered across a 15-ha, 2-m-high red pine plantation. In Fraser Township, the 0.25-ha area within which mortality is occurring in a 4-ha plantation experienced a 5% increase in mortality, and in Ross Township, in the 12-ha, 2.5-m red pine plantation, an increase of 3% in branch mortality was detected on the infested trees. To date, no whole-tree mortality has been detected in this particular plantation.

Spruce Budworm, *Choristoneura fumiferana* (Clem.)

Results of damage surveys, population sampling and egg-mass counts of the spruce budworm will be published with those of other regions at a later date in a report devoted specifically to this insect. The report will provide a complete description and analysis of developments in the spruce budworm situation in Ontario in 1986 and will give infestation forecasts for the province for 1987.

Table 1. Summary of the results of a survey for the pine false webworm at 10 selected pine plantations in the Algonquin Region (counts based on the examination of 150 randomly selected trees at each location).

Location (Twp)	Host	Tree ht (m)	Total area affected (ha)	Total trees per ha	Trees affected (%)	Avg. no. of webmasses per tree	Avg. defoliation of infested trees (%)
Bancroft District							
Mayo	rP	5	5	2,400	1	1	1
Minden District							
Snowdon	wP	2	3	1,500	13	2	5
Stanhope	rP	2	6	2,000	78	6	25
	rP	1	7	2,100	13	1	10
Parry Sound District							
McMurrich	rP	3	18	2,000	60	5	10
Pembroke District							
Ross	rP	2	5	2,500	2	1	1
Brudenell	rP	1	7	2,800	2	1	1
Westmeath	rP	1	2	2,800	1	1	1
Wilberforce	rP	2	5	2,800	1	1	1
South Algona	rP	2	2	2,800	1	1	1

Jack Pine Budworm, *Choristoneura pinus pinus* Free.

In 1986, there was a substantial decline in the area of moderate-to-severe defoliation that has been caused by this pest for the last three years in the Parry Sound District. This season approximately 8,100 ha were considered infested, at various levels of defoliation, and this was an 85% reduction in the total area that was considered infested the previous year. This is the first major decline in population levels since the infestation was first detected in 1982.

Population sampling conducted in June at several locations throughout areas where moderate-to-severe defoliation occurred in 1985 indicated a collapse in populations. Sampling of 45-cm branch tips produced less than one larva per area sampled, whereas in 1985 the same

procedure produced eight to ten larvae per location. The decline was confirmed throughout the entire previously infested area when aerial sketch mapping in mid-July revealed only scattered pockets of defoliation.

In Henvey Township, three small pockets of moderate-to-severe defoliation, totalling some 700 ha, were detected. Two pockets were located along the Georgian Bay shoreline, north and south of the mouth of the Key River, and the third was north of the village of Britt.

An area of approximately 6,500 ha north of the Magnetawan River in Wallbridge Township was considered to be lightly infested. Five additional smaller pockets of defoliation at this level were also delineated. One area, consisting of some 225 ha, was found in the southwest corner of Harrison Township. Two areas were detected in Henvey Township, the first covering some 225 ha, north of the village of Britt, and the second, covering 200 ha, along the north side of Henvey Inlet. Two areas were also found in Wallbridge Township, 150 ha in the extreme northeast corner of the township, and 100 ha along the Naiscoot River (Fig. 1).

Ground and aerial surveys revealed virtually no change from 1985 in the total area within which top killing or tree mortality is occurring throughout the infestation. Approximately 9,000 ha, mainly along the Georgian Bay shoreline, from Point au Baril Channel in Harrison Township northward to Byng Inlet in Wallbridge Township, were considered to have detectable levels of mortality. Damage levels varied from 10 to 100% of the trees affected throughout the infested area. The four semi-permanent mortality plots, which were established for the purpose of examining visually 100 codominant trees within the stand, were retallied this season. Very little change occurred in the percentage of trees that were killed outright; however, the percentage of trees with dead tops increased at three of the four locations. This increase was the result of the severe defoliation that occurred within the infestation in 1985. These data are presented in Table 2.

An egg-mass survey was conducted at 13 locations in the region for the purpose of forecasting population and defoliation levels expected in 1987. At 12 of these locations no egg masses were detected and as a result no defoliation is expected there in 1987. One egg mass was found in the six-branch sample collected along Highway 69 at the Magnetwan River in Wallbridge Township in the Parry Sound District; hence, light defoliation may occur in that particular area. The results of this survey are summarized and presented in Table 3.

Larval and egg-mass surveys conducted this season would indicate that population levels of this destructive pest should continue to decline or completely collapse in the Parry Sound District in 1987.

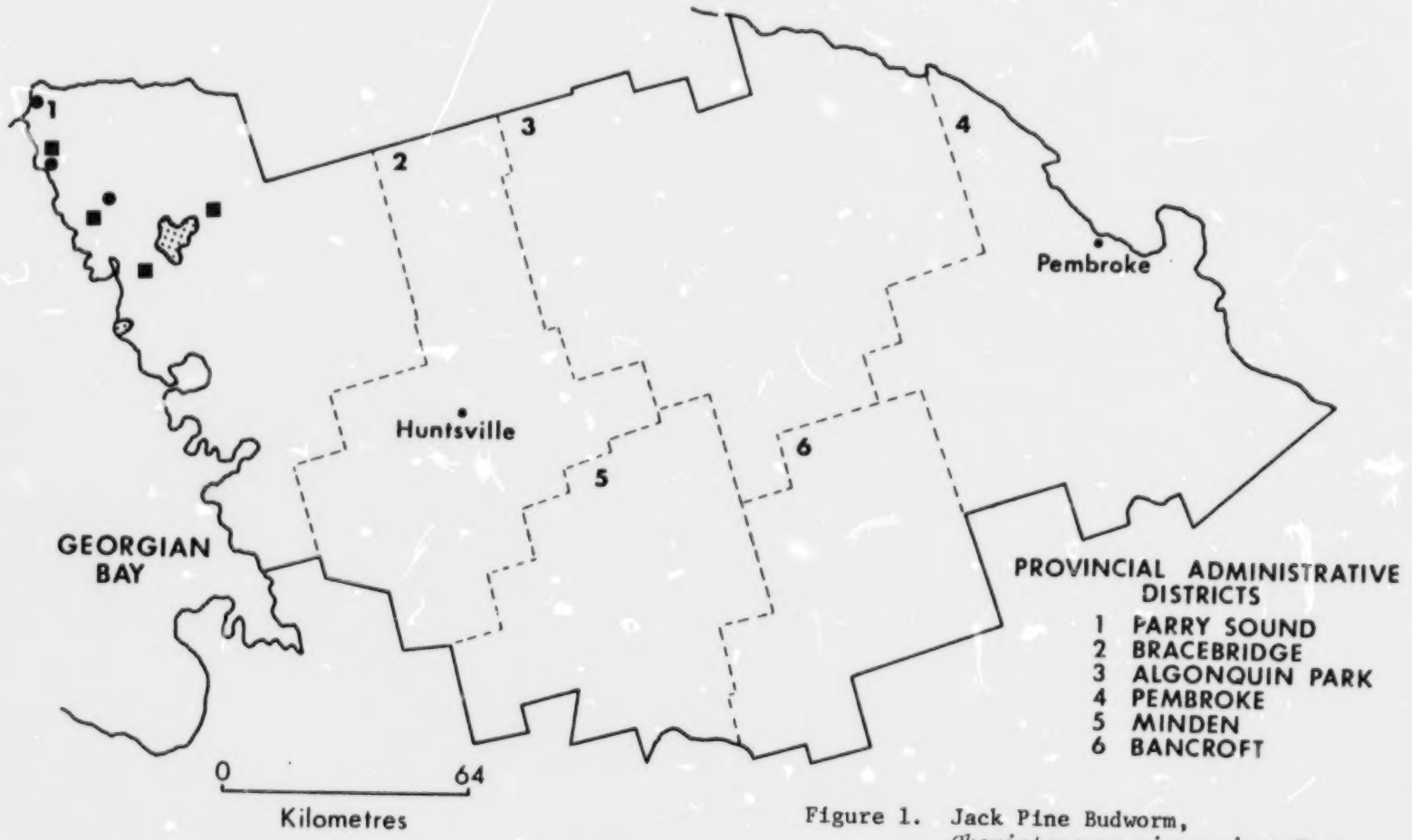

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Figure 1. Jack Pine Budworm, *Choristoneura pinus pinus* Free. Areas within which defoliation occurred in 1986:

Light..... ■ or ▩

Moderate-to-severe.....●

Table 2. Summary of data collected from four jack pine budworm mortality plots in the Parry Sound District in the Algonquin Region (counts based on the examination of 100 codominant jack pine trees at each location).

Location	Avg tree ht (m)	Avg DBH (cm)	Trees alive (%)		Tree mortality (%)		Top kill (%)	
			1985	1986	1985	1986	1985	1986
Wallbridge Township								
Hwy 69	11	19	98	98	2	2	28	38
Jct of Hwys 69 & 529	6	7	98	99	2	1	0	2
Hwy 529	7	15	98	99	2	1	16	19
Carling Township								
Snug Harbour	7	11	95	93	5	7	25	19

Table 3. Summary of jack pine budworm egg-mass counts and defoliation estimates in 1986 and infestation forecast for 1987 in the Algonquin Region (counts based on the examination of six 61-cm jack pine branch tips at each location).

Location	Estimated % defoliation 1986	Total no. of egg masses in 1986	Infestation forecasts for 1987[a]
Algonquin Park District			
Edgar Twp	0	0	N
White Twp	0	0	N
Parry Sound District			
Blair Twp - Stand 303	0	0	N
Carling Twp - Sand Bay	0	0	N
- Snug Harbour	0	0	N
Harrison Twp - Hwy 529A	0	0	N
- Stand 169	0	0	N
Henvey Twp - Still River	5	0	N
Mowat Twp - French River	0	0	N
- Grundy Lk Prov Pk	0	0	N
Wallbridge Twp - Magnetawan R.	6	1	L
- Naiscoot R.	23	0	N
Pembroke District			
Buchanan Twp	0	0	N

[a] N = nil, L = light, M = moderate, H = heavy

Fall Webworm, *Hyphantria cunea* (Dru.)

A slight decrease in population levels of this hardwood pest was recorded this year from the higher levels reported in 1985. Black ash (*Fraxinus nigra* Marsh.) growing on very low, wet sites and choke cherry (*Prunus virginiana* L.) and pin cherry (*P. pensylvanica* L.f.) growing along roadsides were the preferred hosts.

High insect populations, causing more than 75% defoliation, were detected along Hwy 520 east of the village of Ardbeg in Burton Township, Parry Sound District.

Defoliation levels ranging from 30 to 60% were observed and recorded in numerous areas in Conger and Gibson townships, Parry Sound District and in Dalton Township, Minden District. Similar population levels were found along Highway 28, from the town of Apsley to Burleigh Falls in Burleigh Township, Bancroft District and along Renfrew County Road 12 from the village of Greenwood to the village of Westmeath in Westmeath Township, Pembroke District.

Trace-to-light levels of defoliation associated with one or two nests per tree were observed along Renfrew County Road 3 from the village of Castleford to the town of Arnprior in Horton and McNab townships, Pembroke District.

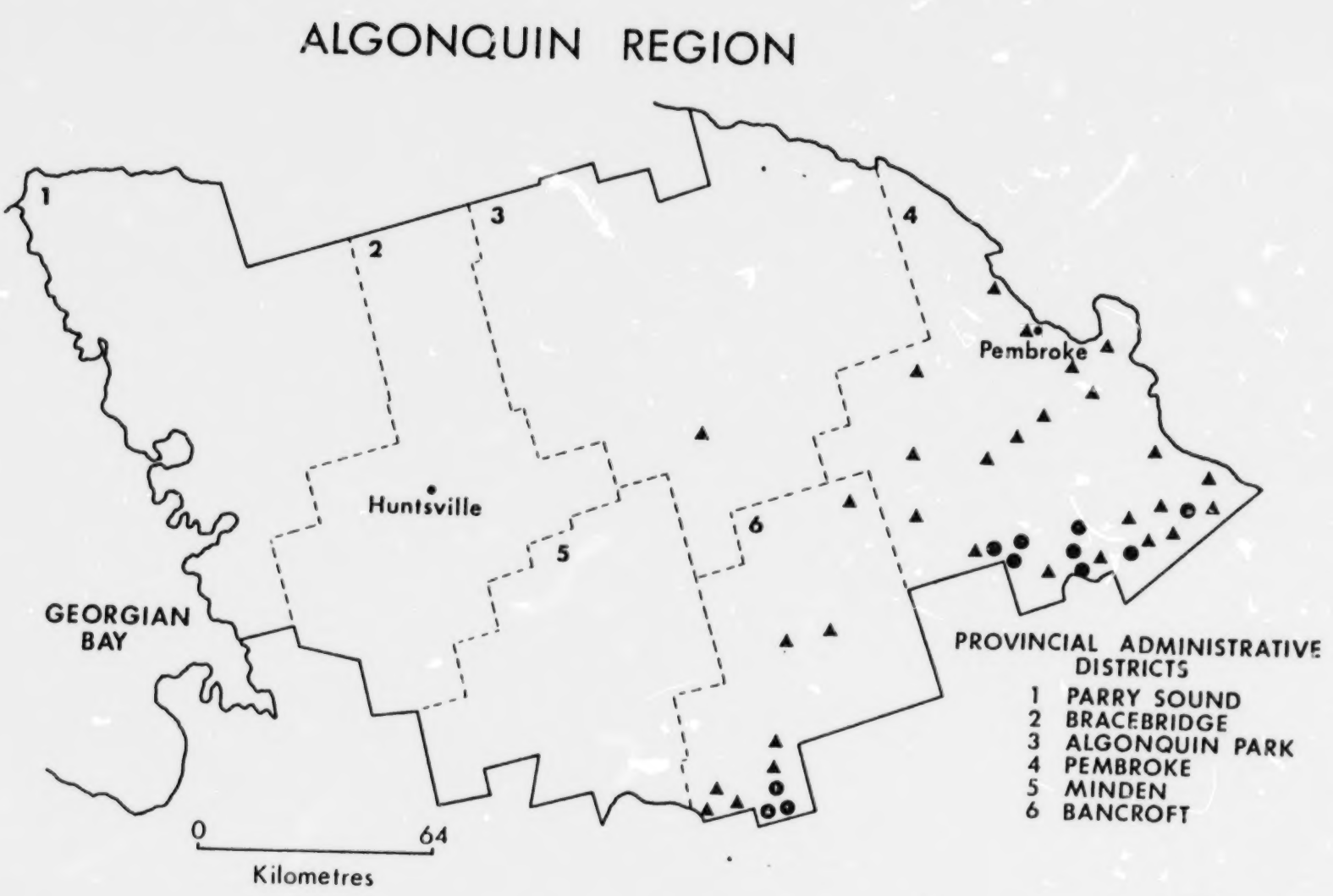
Elsewhere this pest could be found at very low numbers causing lesser amounts of defoliation at numerous scattered locations across the entire region.

Gypsy Moth, *Lymantria dispar* (L.)

For the third consecutive year, population levels and distribution of this introduced pest continued to increase and spread in the region. Numerous small pockets of moderate-to-severe defoliation were aerially sketch-mapped in mid-July; they totalled some 221 ha in the Pembroke District and 164 ha in the Bancroft District (Fig. 2).

In the Pembroke District, defoliation was detected on 18 hilltops, with the defoliated areas ranging in size from less than 1 ha to 15 ha. The majority of the defoliation was found scattered across the Icy Hills in Lyndoch Township, and the Three Mountains area of Griffith Township. The most easterly infested area was located on the northeast side of White Lake in McNab Township.

In the Bancroft District, defoliation was detected in Methuen Township, in small, scattered pockets. Most of the infested area occurred along the southeast shoreline of Kasshabog Lake. A small pocket of defoliation was detected along the north shore of Methuen Lake, and for the second year the most northerly area of defoliation was on an island in Kamaniskeg Lake in Bangor Township.



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Great Lakes Forestry Centre

Figure 2. Gypsy Moth, *Lymantria dispar* (L.)

Areas within which moderate-to-severe defoliation occurred in 1986..... ●

Areas within which trace numbers of larvae were collected in 1986..... ▲

Trace numbers of larvae were collected from several trees randomly selected at an additional 32 locations in the eastern portion of the region. In the Pembroke District, eight to ten caterpillars were easily found at a total of 23 locations, but no apparent defoliation was detectable in these areas. At one of these sites, along Highway 508 east of the village of Calabogie, more than 100 caterpillars were observed in a small stand of trembling aspen (*Populus tremuloides* Michx.). At this site numerous larvae were obviously being killed by a naturally occurring polyhedral virus. Similar low numbers of caterpillars and no visible defoliation were encountered at eight locations in the Bancroft District, and at one in the Algonquin Park District.

In cooperation with the Provincial Parks Branch of OMNR, burlap and pheromone traps were set out at 22 campgrounds in the region. A total of 10 burlap traps were set up at each campground and checked by park staff daily from late May to early June for the presence of gypsy moth larvae. Larvae were collected at only two of the campgrounds--17 at Petroglyphs Provincial Park, and eight at Bonnechere Provincial Park, where last season only five were collected.

In mid-July, the burlap traps were removed and two pheromone traps were set out in each of the 22 campgrounds: one at the campsite where the burlap trapping was conducted and one at the main gate entrance to the park. Positive results were obtained at all 22 parks. There was a very significant increase in the total number of male moths trapped in Algonquin Park, Bancroft, Bracebridge and Parry Sound district parks. These data as well as the burlap trapping results are summarized for the last three years and presented in Table 4.

In all, 10 pheromone traps were set out during the same period at the Canadian Armed Forces Base at Petawawa. In 1986, 174 male moths were recovered and, as in other areas in the region, this was an increase in the number of moths trapped. In 1985, 118 moths were recovered from the same number of traps.

Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Expanding populations of the forest tent caterpillar continue to increase the area of moderate-to-severe defoliation of hardwoods caused by this pest within the region, especially in the Parry Sound District. In 1986, approximately 11,160 ha sustained this level of defoliation, in comparison with only 1,006 ha in 1985 (Fig. 3).

The two pockets of defoliation that occurred in Burton Township last season, which totalled some 818 ha, coalesced and expanded southward this season into East Burpee Township, and now cover some 4,340 ha. The infested area along the east side of Wahwashkesh Lake in the adjacent township of McKenzie increased from 188 ha to 1,740 ha. Three new areas of moderate-to-severe defoliation were detected this season in

Table 4. Summary of the results of larval burlap trapping and adult pheromone trapping of gypsy moth at 22 campgrounds in the Algonquin Region (counts based on 10 burlap traps and two pheromone traps set out at each campground).

Location (Park)	Burlap Trapping: positive (+) or negative (-) trapping of larvae			Pheromone trapping: Total number of male moths trapped		
	1984	1985	1986	1984	1985	1986
Algonquin Park						
Driftwood	-	-	-	0[b]	24	17[b]
Algonquin Park						
Kearny Lake	-	-	-	0[b]	0[b]	2
Pog Lake	-	-	-	0[b]	0[b]	15
Lake of Two Rivers	-	-	-	1[b]	0	1[b]
Mew Lake	-	-	-	1	0	1[b]
Tea Lake	-	-	-	0[b]	1	3[b]
Coon Lake	-	-	-	2[b]	0	19
Rock Lake	-	-	-	1[b]	1	15
Whitefish Lake	-	-	-	0[b]	0	3[b]
Opeongo	-	-	-	0[b]	0[b]	18
Canisby	-	-	-	0[b]	0	3
Bancroft District						
Lake St. Peter	-	-	-	8[b]	10	38
Petroglyphs	-	-	+	13	41	22[b]
Silent Lake	-	-	-	7	13	41
Bracebridge District						
Arrowhead	-	-	-	0	0[b]	19
Mikisew	-	-	-	0	0	18
Parry Sound District						
Grundy Lake	-	-	-	1	0	24
Killbear	-	-	-	1	2	37
Oastler Lake	-	-	-	0	1	14
Sturgeon Bay	a	-	-	a	0	19
Pembroke District						
Bonnechere	-	+	+	2	39	22[b]
Carson Lake	-	-	-	4[b]	21[b]	40

[a] no trapping at campground in 1984
[b] one pheromone trap missing at each location

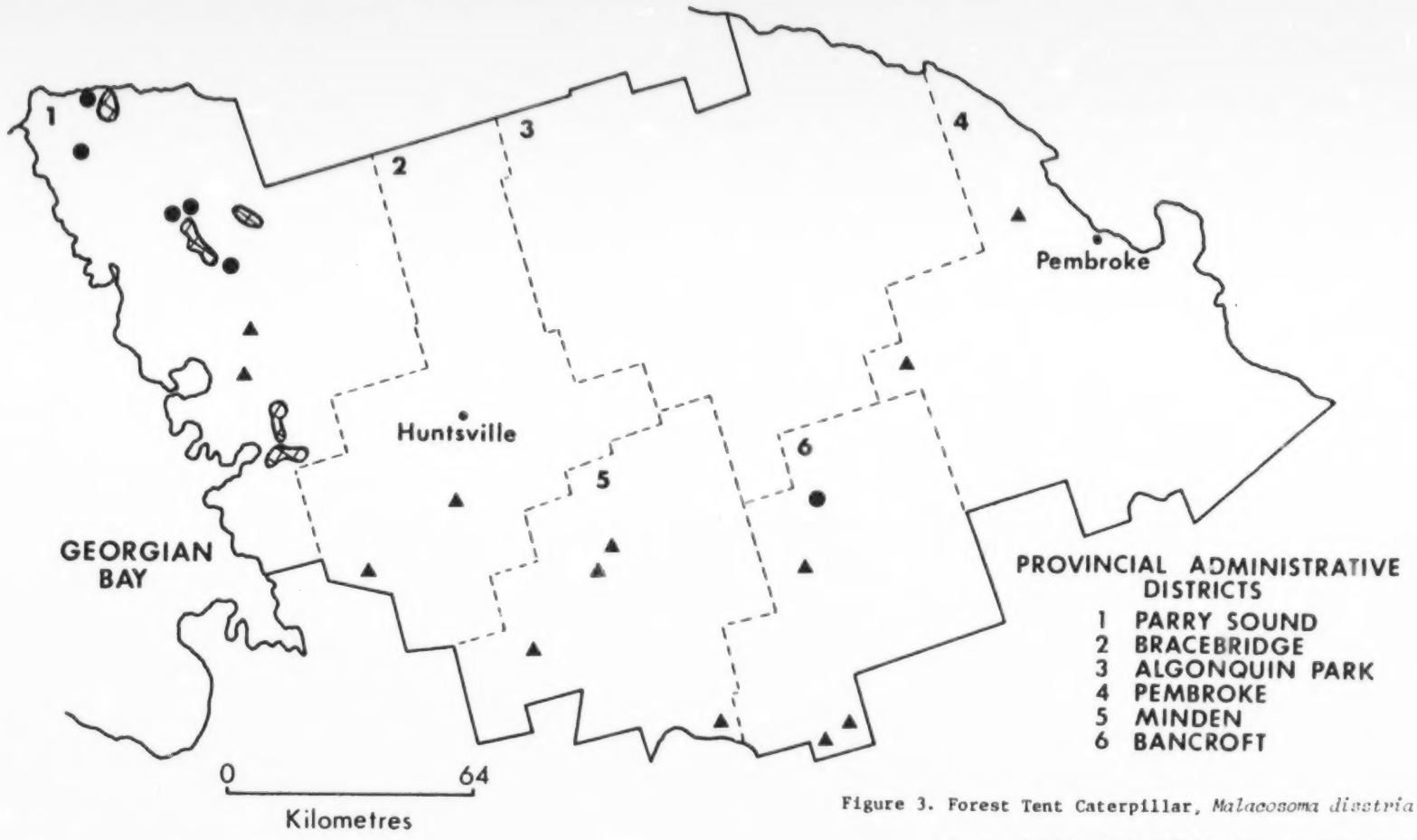

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Figure 3. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Areas within which defoliation occurred in 1986:

Light.....▲

Moderate-to-severe..... ● or ⊠

the Parry Sound District. The largest extended from Healy Lake at the southern end of Conger Township northward to Otter Lake in Foley Township, and covered some 3,370 ha. The second area was located in the northwest portion of Grundy Lake Provincial Park in Mowat Township, where 1,700 ha were heavily defoliated. The third area, only 5 ha in size, was detected along Highway 69 on the south side of the Key River in Henvey Township. Trembling aspen was the primary host in the northern portion of the district, and sugar maple (*Acer saccharum* Marsh.) in the southern areas of infestation. Elsewhere within the region, low numbers of larvae and defoliation levels were commonly detected at numerous, scattered locations. In the Bancroft District, a 0.5-ha stand of trembling aspen in Herschel Township sustained an estimated 50% defoliation, and 10 to 20% defoliation was detected on single roadside red oak (*Quercus rubra* L.) trees scattered along Highways 46 and 44 at the southern end of Methuen Township. In the Bracebridge District, scrub red oaks growing on very open, rocky sites along Muskoka County Road 13, extending from Highway 169 to Morrison Lake, were also defoliated in the 10 to 20% range. Similar levels were found in a 1.0-ha red oak stand in McKay Township, and on ornamental red oak at Carson Lake Provincial Park in Jones Township, Pembroke District.

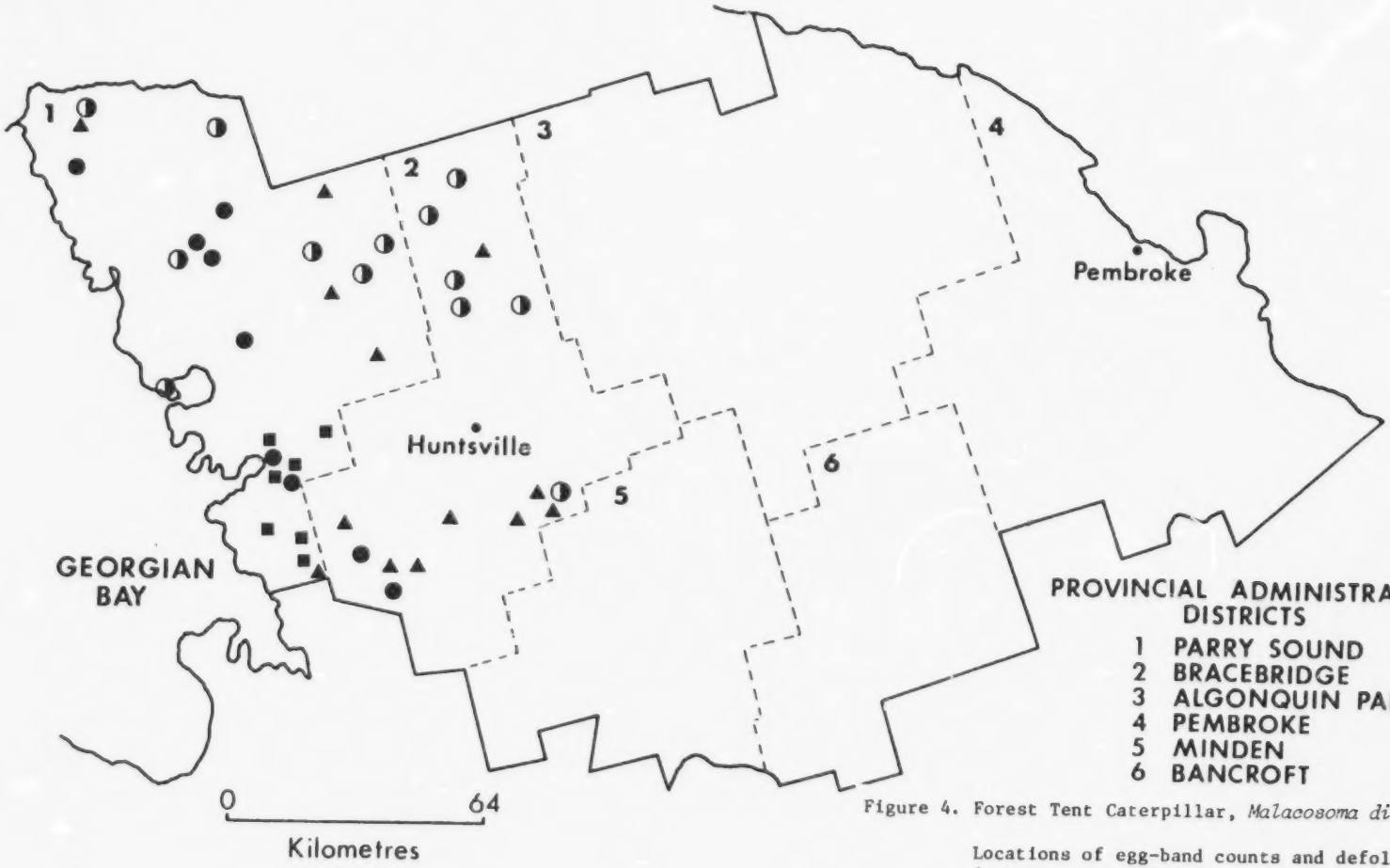
Trace numbers of caterpillars causing less than 1% defoliation were frequently encountered on forest and ornamental trees throughout the Parry Sound District, and at several locations in the Bracebridge, Minden, Bancroft and Pembroke districts.

A special survey to count egg bands that had been laid on twigs in early July by the female moth was conducted at 42 locations across the western portion of the region to forecast defoliation levels for 1987 (Fig. 4). The data collected from this survey are summarized in Table 5. All areas defoliated in 1986 are expected to persist and expand in 1987. A major expansion is forecasted for the southern end of the Parry Sound District, spreading eastward into the Lake Joseph area of the Bracebridge District.

Balsam Fir Sawfly, *Neodiprion abietis* complex

There was little change this season in the area defoliated by this sawfly. Once again some 1,300 ha were considered infested; however, several new pockets of heavy defoliation were detected within the infestation boundaries. Damage throughout the infestation was usually confined to the upper portion of the crowns, and defoliation ranged from 10 to 15%.

Throughout some 400 ha of relatively pure stands of balsam fir (*Abies balsamea* [L.] Mill.) along the south shore of North Tea Lake in Balantyne and Wilkes townships, Algonquin Park District, defoliation levels averaging 50% were detected from the air.



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Great Lakes Forestry Centre

Figure 4. Forest Tent Caterpillar, *Malacosoma disstria* Hbn.

Locations of egg-band counts and defoliation forecasts for 1987:

Nil.....◑

Light.....▲

Moderate.....■

Severe.....●

Table 5. Summary of forest tent caterpillar egg-band counts at 42 locations in the Algonquin Region (counts based on the examination of one to three trees at each location).

Location (Twp)	Host	Avg DBH (cm)	No. of trees examined	Avg no. of egg-bands per tree	Infestation forecasts for 1987[a]
Bracebridge District					
Armour	sM	18.0	3	0.0	N
	sM	19.0	3	0.0	N
Bethune	sM	17.5	3	0.0	N
Laurier	sM	25.0	3	0.0	N
Macaulay	sM	18.4	3	2.3	L
McLean	sM	19.4	3	0.7	L
Medora	sM	22.1	3	26.7	S
	sM	18.5	3	4.3	L
Proudfoot	sM	19.8	3	0.3	L
Ridout	sM	21.4	3	0.3	L
	sM	19.5	3	2.0	L
	sM	21.2	3	0.0	N
Strong	sM	17.5	3	0.0	N
Wood	sM	17.4	3	5.3	L
	tA	14.9	3	6.0	S
	sM	18.0	3	1.3	L
Parry Sound District					
Burton	sM	13.9	3	5.7	S
	sM	12.4	3	0.0	N
Carling					
Killbear Prov. Pk	sM	14.5	3	0.0	N
Christie	sM	10.9	3	10.0	S
Chapman	sM	14.1	3	0.0	N
Conger	sM	12.8	3	12.0	S
	sM	10.3	3	2.0	M
	sM	8.4	3	3.3	M
	sM	14.7	3	8.0	S
	sM	15.0	1	42.0	S
Croft	sM	15.1	3	0.0	N
East Burpee	tA	16.0	1	67.0	S
Ferrie	sM	14.5	3	0.3	L
Freeman	sM	12.5	3	2.3	M
Gibson	rO	15.9	3	1.7	L
	rO	12.1	3	2.0	M
	sM	14.6	3	8.0	M
Humphrey	sM	8.6	3	1.7	M
McConkey	sM	11.6	3	0.0	N

(cont'd)

Table 5. Summary of forest tent caterpillar egg-band counts at 42 locations in the Algonquin Region (counts based on the examination of one to three trees at each location) (concl.).

Location (Twp)	Host	Avg DBH (cm)	No. of trees examined	Avg. no. of egg-bands per tree	Infestation forecasts for 1987[a]
Parry Sound District (cont'd)					
McKenzie	tA	15.5	1	71.0	S
McMurrich	sM	15.3	3	2.0	L
Mowat	tA	9.3	3	8.3	S
- Grundy Lk Prov Pk	tA	10.5	3	0.0	N
	tA	11.3	3	0.3	L
Ryerson	sM	13.7	3	0.0	N
Spence	sM	10.8	3	0.7	L

[a] N = nil, L = light, M = moderate, S = severe

As was the case last season, approximately 400 ha of continuous defoliation, averaging 25%, occurred along Highway 17 south of the town of Pembroke in Stafford Township, Pembroke District.

Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

For the second consecutive year, population levels of this sawfly have increased throughout the region. The actual number of colonies in the majority of the red pine plantations examined was usually quite low; however, the frequency with which several colonies could be found scattered across plantations was very high (Fig. 5).

A high population, causing an average of 75% defoliation, was found on a roadside planting along Highway 11 in Macaulay Township, Bracebridge District. It was estimated that at least three colonies were present on each of the 1-m trees, and mortality may occur in this plantation because of the severe defoliation.

Moderate levels of defoliation, ranging from 20 to 40%, were detected and evaluated in plantations in Mayo Township, Bancroft District, Laxton Township, Minden District, and Raglan and North Algona townships, Pembroke District. These data are summarized in Table 6.

The Lecontvirus was applied by OMNR at a total of 74 locations across the region. In the Bancroft District, seven plantations, totalling some 40 ha, were treated; in the Bracebridge District, four plantations, totalling 28 ha; in the Minden District, 36 plantations, total-

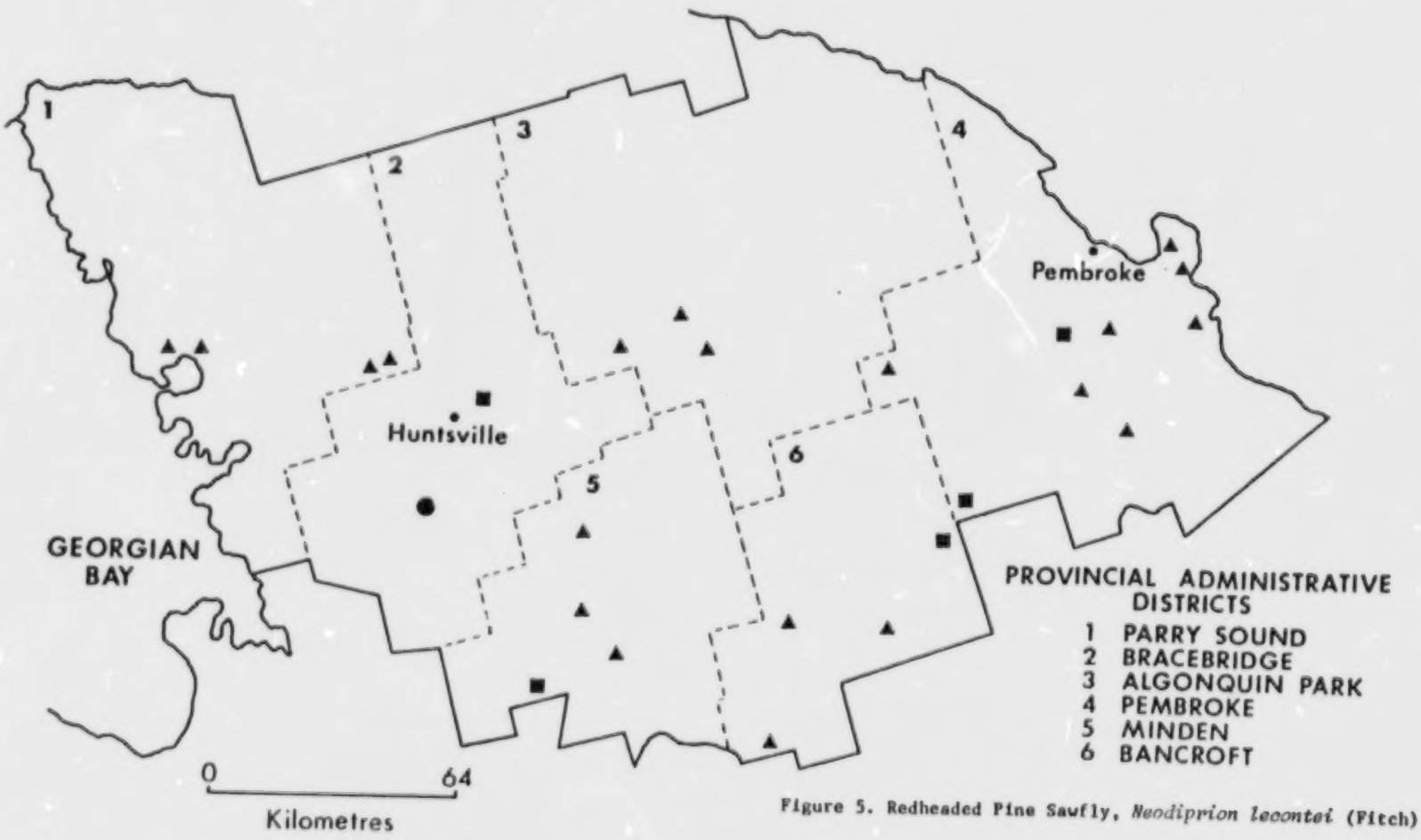

Figure 5. Redheaded Pine Sawfly, *Neodiprion lecontei* (Fitch)

Forest Insect and Disease Survey
Great Lakes Forestry Centre

Areas within which various population levels were detected in 1986:

Light..... ▲

Moderate..... ■

High..... ●

Table 6. Summary of damage caused by the redheaded pine sawfly at 14 locations in the Algonquin Region in 1986 (counts based on the examination of 150 red pine trees at each location).

Location (Twp)	Avg ht of trees (m)	Total area affected (ha)	No. of trees per ha	Trees infested (%)	Avg no. of colonies per tree	Avg defoliation of infested trees (%)
Algonquin Park district						
Nightingale	2.0	3	2,800	3	3	10
Bancroft District						
Dungannon	2.0	2	2,700	2	1	10
Mayo	1.0	3	2,500	3	1	30
Bracebridge District						
Macaulay	1.0	2	2,200	76	3	75
Minden District						
Minden	2.3	3	2,100	6	1	5
Laxton	2.3	7	2,000	8	2	40
Snowdon	2.0	1	1,000	1	1	5
Stanhope	1.0	3	2,400	3	1	5
Pembroke District						
Wilberforce	1.5	5	2,800	1	1	1
Raglan	7.0	2	2,600	10	6	30
North Algona	1.5	1	2,800	20	4	20
Westmeath	2.5	4	2,800	3	2	1
South Algona	2.0	2	2,800	1	1	1
Sebastopol	1.0	3	2,800	2	2	1

ling 14 ha; in the Parry Sound District, 17 plantations, totalling 191 ha; and in the Pembroke District, 10 plantations, totalling 20 ha. The virus was hand sprayed at the standard application rates of 5×10^9 polyhedral inclusion bodies (PIBs) per hectare for 1st- and 2nd-instar larvae, and at 1×10^{10} PIBs per hectare for later-instar larvae. At all locations the biological control appeared to be very effective.

Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross

This season a further increase has taken place in the areas within which defoliation occurred in 1985 and the infested area has spread from the Pembroke and Algonquin Park districts southward into the Bancroft District (Fig. 6). High population levels caused 40% defoliation of small, scattered jack pine stands and open-grown trees in Chandos and Methuen townships, Bancroft District.

Defoliation averaging 25% was scattered across 7,500 ha in small, relatively pure pockets or mixed jack pine stands from the town of Barry's Bay eastward to Round and Golden lakes, then northward to the town of Pembroke. Similar defoliation was recorded along Hwy 17 from just south of the town of Petawawa to the village of Rolphton in the Pembroke District.

In a 5-ha plantation in Radcliffe Township, Pembroke District, the 11-m trees sustained 30% defoliation, and in a 0.5-ha plantation in Herschel Township, Bancroft District, there was 25% defoliation of 10-m-high trees.

Jack pine sawfly occurs in scattered locations across the entire work area and trace population levels of this insect could be observed at numerous locations; however, they caused less than 1% defoliation.

Bruce Spanworm, *Operophtera bruceata* (Hlst.)

Populations of this early spring hardwood defoliator continue to increase in the central portion of the region. Sugar maple was heavily defoliated across some 172,000 ha, mainly in the Minden and Bancroft districts (Fig. 7).

Maple stands from Minden Township in the Minden District, eastward to Monteagle Township in the Bancroft District, sustained 75 to 100% defoliation. Stands growing on hilltops were especially hard hit. As the damage progressed down the hills into the valleys, the heavy defoliation was usually confined to the regeneration and understory trees, with just the base of the main canopy being heavily defoliated. This level and type of defoliation was aerially detected over approximately 400 ha in the northwest corner of Sebastopol Township and at the adjoining edges of South Algona and Brudenell townships, Pembroke District, and in a single maple stand, 125 ha in size, in Lyell Township, Algonquin Park District.

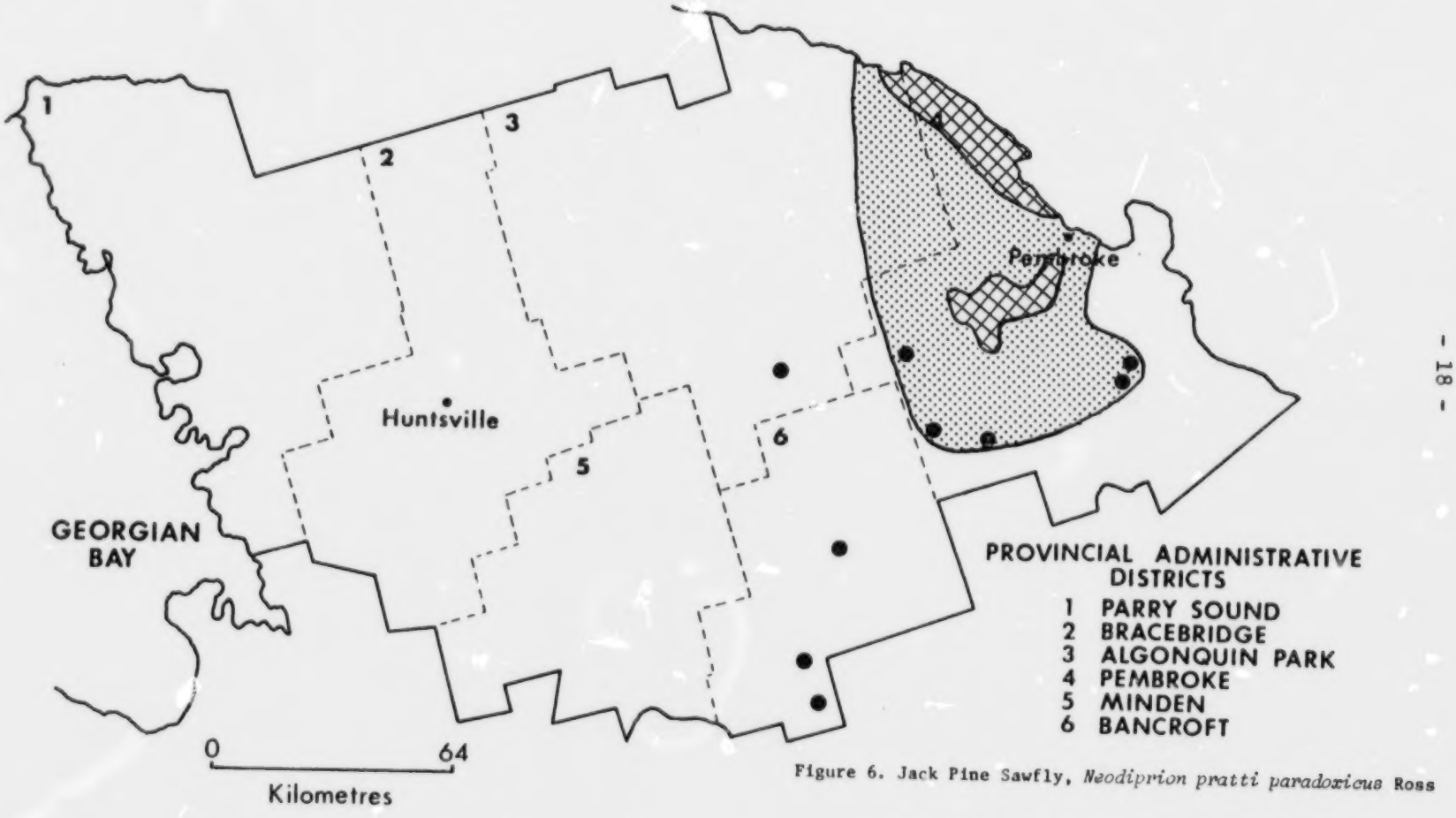

Figure 6. Jack Pine Sawfly, *Neodiprion pratti paradoxicus* Ross

Areas within which defoliation occurred in 1986

Light.....

Moderate-to-severe..... ● or

Forest Insect and Disease Survey
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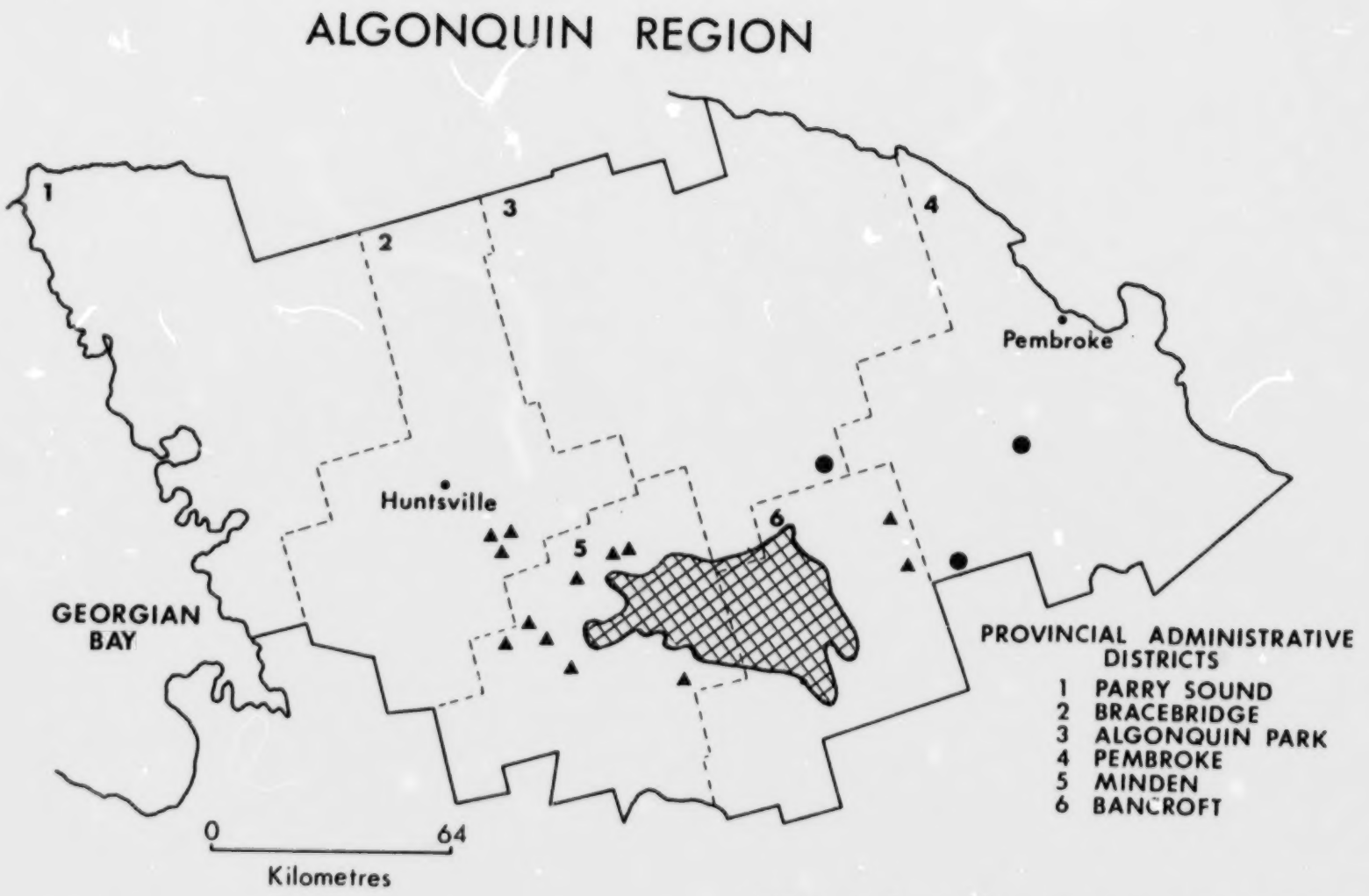

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Figure 7. Bruce Spanworm, *Operophtera bruceata* (Hlst.) Areas within which defoliation occurred in 1986:

Light..... ▲

Moderate-to-severe... ● or ⊠

Scattered pockets of lighter levels of defoliation, ranging from 30 to 50% in the main crowns and 75% on the understory material, were detected as far west as McClintock and Ridout townships in the Bracebridge District. In all, approximately 3,000 ha were considered infested to this extent throughout these two townships.

Defoliation levels of 5 to 20% were found primarily on regeneration in numerous stands in Sherborne, Havelock, Guilford, Harburn, Standhope, Hindon, Minden, Dysart and Glamorgan townships, Minden District, and in Bangor and Carlow townships along the east side of Bancroft District.

Although infestations of this spanworm historically last only two to three years and then collapse, it appears from the heavy moth flight reported in October that this current infestation will persist for a fourth year. Infestations are usually controlled by natural agents, such as egg and larval parasites and predators, and the most important factor, natural viral diseases.

Maple Leafcutter, *Paraclemensia acerifoliella* (Fitch)

There was a marked decrease in both severity of defoliation and area infested in 1986. Damage by this insect peaked in 1984 when some 270 ha of heavy defoliation occurred, following two years of gradual increase. The pest is now expected to return to a normal endemic level.

A single stand comprising some 8 ha sustained approximately 75% defoliation throughout the crowns of the semimature sugar maple at Head Lake in Laxton Township, Minden District. Two similar mature sugar maple stands had 30% defoliation damage; one in a 40-ha stand on the south shore of St. Ola Lake in Limerick Township, Bancroft District, the other in a 30-ha stand northwest of the town of Eganville in Wilberforce Township, Pembroke District.

Trace-to-light defoliation, usually confined to understory trees and regeneration, was detected in Laxton, Dysart and Havelock township, Minden District, and at Hardwood Hill in Peck Township, Algonquin Park District.

Minor Insects

Eastern Tent Caterpillar, *Malacosoma americanum* F.

Extremely high populations of this insect caused total defoliation of open-grown roadside choke cherry, pin cherry, red oak, bur oak (*Quercus macrocarpa* Michx.), and hawthorn (*Crataegus* spp.) in numerous widely scattered pockets throughout much of the southern half of the region.

One hundred percent defoliation occurred on roadside host trees in pockets along Hwy 28 from the town of Bancroft to Burleigh Falls in the Bancroft District, along Hwy 36 in Harvey Township, and throughout most of Digby and Laxton townships, Minden District. Open-grown, 10-m oaks had similar damage levels along Muskoka County Road 13 southeast of the town of Bala in Wood Township, Bracebridge District.

Defoliation ranging up to 75% was recorded along Hwy 62, from the town of Pembroke to Round Lake in the Pembroke District, and along Hwy 36 throughout Harvey Township, Minden District.

Elsewhere across the region, tents of this pest could easily be seen along roadsides and fence lines causing anywhere from 5 to 100% defoliation on the host tree.

Pine Gall Weevil, *Podapion gallicola* Riley

Branch and tree mortality are continuing in the known areas of infestation in the Algonquin Park and Pembroke districts where this gall-forming weevil has been found in the past. A pest of semimature and mature red pine stands, it has only recently become significant in this region. The adult lays eggs on one-year-old twigs and the insect remains in the tree for four years. The galls are formed on the branches by hypertrophy of the xylem tissue surrounding the feeding larvae. This eventually causes the bark to die around the branch, and kills the branch.

In a 1-ha plantation of semimature 15-m red pine trees, in McNab Township, Pembroke District, a total mortality rate of 6% has been attributed to this pest. This represents a 1% increase in mortality from the previous season.

Branch mortality has caused a 25% reduction in crown size on 25 mature, 20-m trees at a picnic area on Pretty Lake in Edgar Township, Algonquin Park District.

Flat Leaftier, *Psilocorsis reflexella* Clem.

This hardwood pest was commonly encountered in numerous stands across the region. Trembling aspen and red oak were the primary hosts, with small pockets of aspen, 0.5 ha, often being completely browned by this leaftier by late August.

The heaviest damage was encountered along Highway 124 throughout Hagerman and Croft townships in the Parry Sound district. As was the case last season, wherever aspen or oak occurred along the highway, approximately 80% of the foliage was severely browned. This level of damage was also detected in a 20-ha mixed aspen-oak stand growing along

Muskoka County Road 38 in Wood Township, Bracebridge District, and in a 20-ha mixed hardwood-softwood stand in Stanhope Township, Minden District.

Moderate damage levels (30 to 40% defoliation) were detected along Highway 124 in McDougall Township on trembling aspen and white birch (*Betula papyrifera* Marsh.) in the Parry Sound District. This level was found on trembling aspen along Hastings County Road 5, from Highland Grove in Cardiff Township to birds Creek in Herschel Township, Bancroft District, and along Highway 530 at Maple Lake in Stanhope Township, Minden District.

Elsewhere in the region, this pest was commonly found causing 1 to 5% defoliation in aspen and oak stands at numerous locations.

Table 7. Other forest insects.

Insect	Host(s)	Remarks
Acrobasis betulella Hlst. Birch tubemaker	wB	30% defoliation in a 20-ha mixed hardwood stand in Stanhope Twp, Minden District
Arge pectoralis (Leach) Birch sawfly	wB	3% defoliation scattered throughout a 40-ha mixed hardwood stand in Glamorgan Twp and a 75-ha area in Guilford Twp, Minden District
Argyrotaenia quercifoliana Fitch	rO	3-5% defoliation on roadside trees along Hwy 121 in Minden Twp, Minden District
Bucculatrix ainsliella Murt. Oak skeletonizer	rO	5-10% defoliation of red oak in a 15-ha natural forest along Hwy 507 in Cavendish Twp, Minden District
Cameraria hamadryadella (Clem.) Solitary oak leafminer	wO, bO	2% defoliation detected along Hwy 36 west of Burleigh Falls in Harvey Twp, Minden District; trace populations observed in McNab Twp, Pembroke District
Caulocampus acericaulis MacG. Maple petiole borer	sM	1% defoliation in a 50-ha mixed hardwood stand in Macaulay Twp, Bracebridge District, and in a 15-ha stand in Minden Twp, Minden District

(continued)

Table 7. Other forest insects (continued).

Insect	Host(s)	Remarks
Cephalcia frontalis Westw. Pine webspinning sawfly	rP	0.5% defoliation reported in a 2-ha young plantation in South Algona Twp, Pembroke District
Contarinia baer (Prell)	rP	1 to 3% of the foliage damaged on 25% of the 2.5-m-tall trees in a 4-ha plantation in Westmeath Twp, Pembroke District; 1% defoliation and 43% of the 2-m-tall trees affected in a 7-ha plantation in Laxton Twp, Minden District.
Croesia semipurpurana (Kft.) Oak leaf shredder	rO	3 to 5% defoliation on roadside, natural trees along Hwy 121 in Minden Twp, Minden District
Croesus latitarsus Nort. Dusky birch sawfly	yB	A single colony was found in Macaulay Twp, Bracebridge District.
Dioryctria zimmermani (Grt.) Zimmerman pine moth	wP	Up to three larval stem wounds per tree were recorded on 4% of the trees in a semimature, 7-ha eastern white pine (*Pinus strobus* L.) plantation in Wylie Twp, Pembroke District.
Diprion similis (Htg.) Introduced pine sawfly	wP	Trace population levels were found feeding on young trees in a 3-ha plantation in Wicklow Twp, Bancroft District. Single larvae were found in Freswick Twp, Algonquin Park District and in Wylie Twp, Pembroke District.

(continued)

Table 7. Other forest insects (continued).

Insect	Host(s)	Remarks
Epinotia solandriana Linn. Birch-aspen leafroller	wB	There was 5% foliar damage in a 25-ha, mixed natural stand in Sproule Twp. Similar damage levels could be found in scattered pockets along hwys 60 and 127 in the Algonquin Park District. There was 1-2% damage along Hwy 62 from the village of Maynooth to Combermere, Bancroft District.
Erannis tiliaria (Harr.) Linden looper	deciduous	Trace numbers were easily collected in mixed hardwood stands at Harris Lake in Ferguson Twp, Parry Sound District; along Hwy 121 in Minden Twp and at Tory Hill, Monmouth Twp, Minden District; and west of Bala in Wood Twp, Bracebridge District.
Fenusa pusilla (Lep.) Birch leafminer	wB	Foliage along Hwy 28 from the town of Bancroft to Burleigh Falls, Bancroft District was 100% affected, and 80% foliar damage was recorded in scattered 0.5-ha pockets in McKay Twp, Pembroke District. There was a decrease in damage levels along Hwy 60 through Algonquin Park District, from the severe high level recorded in 1985 to the low-to-moderate level in 1986.
Gonioctena americana (Schaef.) American aspen beetle	aspen	trace numbers causing less than 3% defoliation on roadside aspen along Hwy 121 west of the town of Bancroft, Bancroft District

(continued)

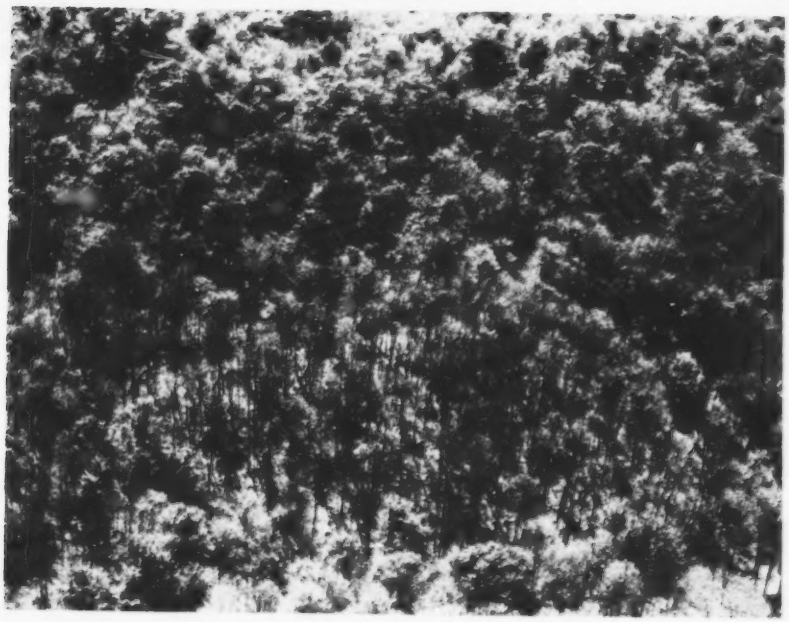
Table 7. Other forest insects (continued).

Insect	Host(s)	Remarks
Neodiprion nanulus nanulus Schedl. Red pine sawfly	rP	There was 60% defoliation in a 5-ha mature, natural stand in Gratton Twp. Of the 1.7-m-tall trees in a 0.5-ha plantation in Westmeath Twp 54% had an average of 16% defoliation. Up to 10% foliar damage was recorded in Lyndoch and Bagot twps, Pembroke District, and in Mayo Twp, Bancroft District.
Neodiprion sertifer (Geoff.) European pine sawfly	mP, rP	Of the mugho pine (*Pinus mugo* Turra var. *mughus* Zenari) planted along Hwy 11, 42% were infested with an average of 1 colony per tree in Macaulay Twp, Bracebridge District. Trace levels were collected in a 3.5-ha, 5-m red pine plantation in Burleigh Twp, Bancroft District.
Pikonema alaskensis (Roh.) Yellowheaded spruce sawfly	wS	There was 90% defoliation on 1-m-tall roadside trees along Hwy 60 west of Grassmere in Chaffey Twp, Bracebridge District; 70% defoliation on 3-m-tall trees in Horton Twp, Pembroke District; and 10% defoliation on 1-m-tall trees in Faraday Twp, Bancroft District. In all areas only very low numbers of trees were affected.
Pissodes approximatus Hopk. Northern pine weevil	rP	In a 72-tree 1-m ornamental plantation in Mew Lake Campground in Canisbay Twp, Algonquin Park District, 80% were affected with 40% mortality.

(continued)

Table 7. Other forest insects (concluded).

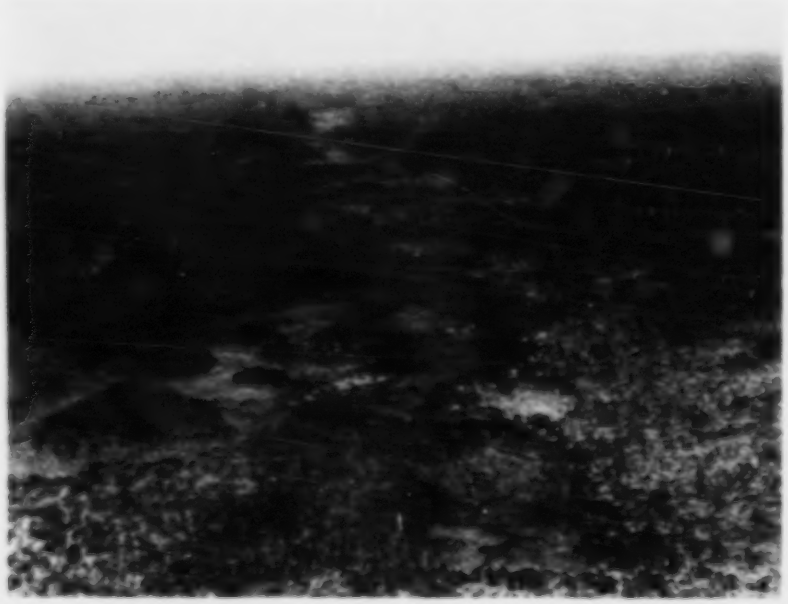
Insect	Host(s)	Remarks
Pissodes strobi (Peck) White pine weevil	wP	On scattered, open-grown trees in a 5-ha area in Burleigh Twp, Bancroft District 50% of the leaders were affected. In a 4-m-tall, 1.5-ha understory plantation in Ross Twp, Pembroke District, 31% of the leaders were attacked. Naturally regenerating, 3-m-tall roadside trees along Hwy 121 in Snowdon Twp, Minden District were found to have 8% affected leaders.
Pristiphora erichsonii (Htg.) Larch sawfly	larch	There was 30% defoliation on scattered, mature roadside trees along Hwy 127 from Hwy 60 in the Algonquin Park District to Lake St. Peter in the Bancroft District. Up to 10% defoliation was recorded on ornamental, 5-m-tall European larch (*Larix decidua* Mill.) at Mew Lake campground in Canisbay Twp, Algonquin Park District.
Pristiphora geniculata (Htg.) Mountain-ash sawfly	As	very common on ornamental trees within the towns of Parry Sound and Magnetawan in the Parry Sound District
Pseudexentera cressoniana Clem. Oak olethreutid leafroller	rO	Very low numbers caused up to 5% defoliation on roadside trees along hwy 121 in Minden Twp, Minden District.



Heavy defoliation of sugar maple (*Acer saccharum* Marsh.) caused by the Bruce spanworm, *Operophtera bruceata* (Hlst.)

Defoliation and webmasses on the branches of a red pine (*Pinus resinosa* Ait.) caused by the pine false webworm, *Acantholyda erythrocephala* (L.)

Red pine mortality caused by Scleroderris canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard



The path of tornado damage across the central portion of the Minden District

TREE DISEASES

Major Diseases

Anthracnose, *Apiognomonia errabunda* (Roberge) Höhnel,
Aureobasidium apocryptum (Ell. & Ev.) Hermanides-Nijhof,
Discula campestris (Pass.) v. Arx

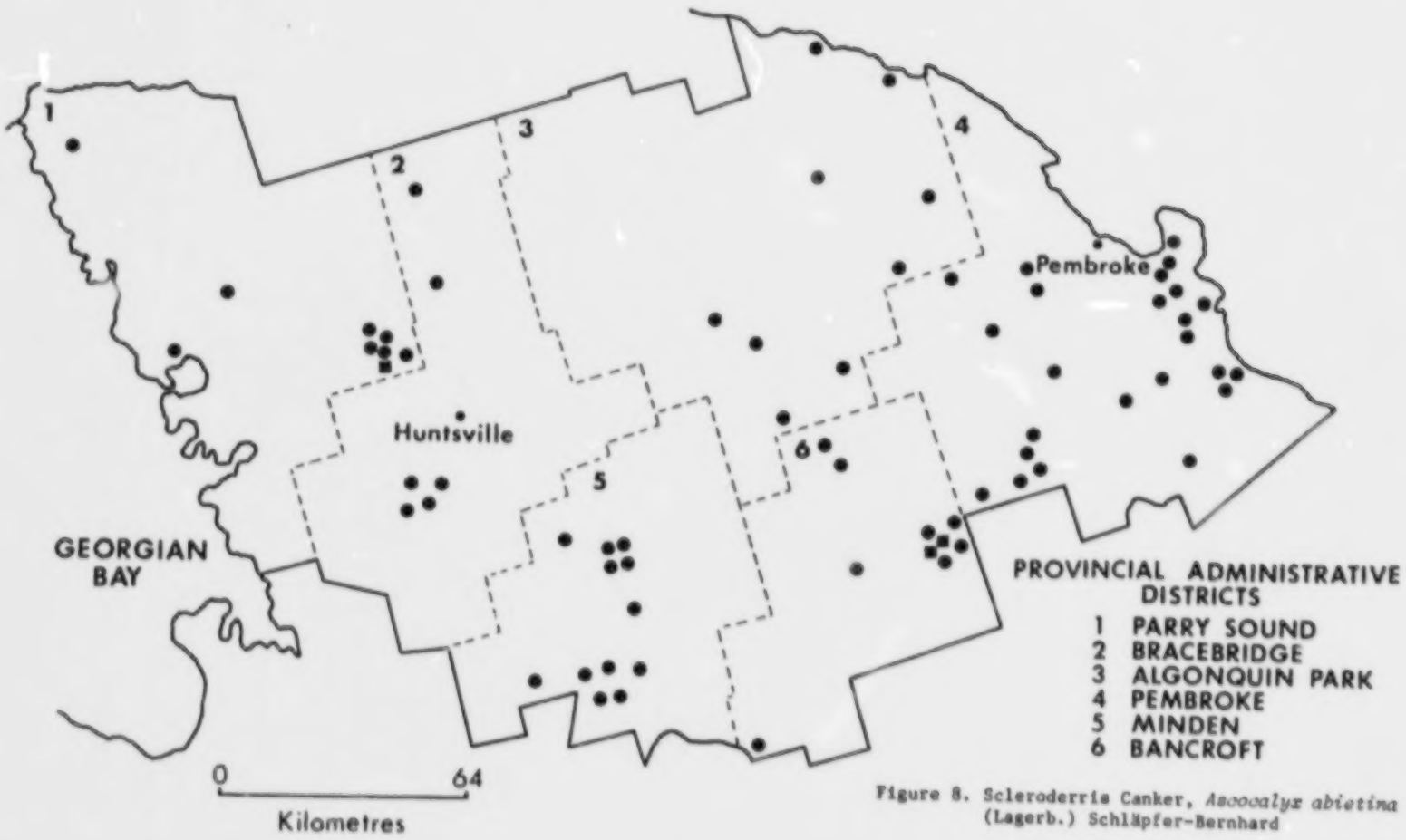
A cool, wet summer resulted in foliar damage to trees of all age classes of hardwoods caused by a variety of anthracnose diseases at widely scattered locations across the region. In a 100-ha mixed hardwood stand in Henvey Township, Parry Sound District, 75 to 100% of the foliage of the intermediate-sized and regeneration red maple (*Acer rubrum* L.) was affected by *Aureobasidium apocryptum*. This same disease caused 50% defoliation of understory sugar maple in a 0.5-ha woodlot in Wilberforce Township, and a 20% infection level was detected on open-grown, juvenile, ornamental sugar maple in Ross Township, Pembroke District. Scattered, individual, semimature sugar maples sustained approximately 15% defoliation caused by *Discula campestris* throughout a 20-ha natural stand in the central portion of Minden Township, Minden District.

In Alice Township, Pembroke District, beech (*Fagus grandifolia* Ehrh.), which comprises 1-2% of the hardwoods in many stands, had an estimated 60% of its foliage browned by *Apiognomonia errabunda*. In McNab Township, along Highway 3 from the village of Castleford to the town of Arnprior, 100% of the foliage on roadside sugar maple showed discoloration caused by *Discula umbrinella* (the imperfect stage of *A. errabunda*.

Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

For the eight consecutive year, extensive aerial and ground surveys were conducted throughout the region for evidence of this disease. As in 1985, three red pine plantations were found with symptomatic damage that was later confirmed by serological testing to be caused by the European race of this disease. These three new infection centers were within the immediate vicinity of two of the locations in which the disease was found in 1985 (Fig. 8). In Mayo Township, Bancroft District, two 5-ha red pine plantations, 2.0 and 0.5 m in height, were found to have 1% of the trees affected. In a 1-ha red pine plantation in McMurrich Township, Parry Sound District, 15% of the 4-m trees were heavily infected and 5% of the trees were dead.

At an additional 66 plantations, at widely scattered locations, a minimum of 500 trees were examined visually for any evidence of the disease. At two of these locations, both in Macaulay Township in the Bracebridge District, the presence of Scleroderris canker was confirmed, and 1% of the red pine at each site were being affected. The actual race has yet to be determined by serological testing. The data from this survey are summarized in Table 8.



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Great Lakes Forestry Centre

Figure 8. Scleroderris Canker, *Ascocalyx abietina* (Lagerb.) Schläpfer-Bernhard

Locations in which the European race of Scleroderris canker was detected in 1986..... ■

Additional locations in which pine plantations were examined in 1986.. ●

Table 6. Summary of the results of a special survey for Scleroderris canker at 69 locations in the Algonquin Region in 1986 (counts based on the examination of 500+ red pine trees at each location).

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Algonquin Park District					
Airy	1.5	1,500	2	0	0
Lyell	5.0	300	2	0	0
Sproule	6.0	2,100	1	0	0
Sabine	4.8	2,900	2	0	0
Maria	3.0	2,800	8	0	0
White	2.0	750	10	0	0
Stratton	3.0	2,800	1	0	0
Guthrie	3.0	2,800	8	0	0
Head	1.0	2,400	20	0	0
Bancroft District					
Mayo	13.0	1,900	2	0	0
	0.5	2,800	4	4[a]	1
	2.0	2,200	5	1[a]	0
	0.5	2,500	5	1	0
	5.0	2,400	5	0	0
	4.0	2,100	12	1	0
McClure	2.0	2,800	2	0	0
	1.0	2,500	1	0	0
Burleigh	4.0	2,200	4	0	0
Dungannon	4.5	2,200	7	0	0
Bracebridge District					
Strong	17.0	1,000	3	0	0
Macaulay	2.5	2,100	2	1[b]	0
	6.0	2,000	5	0	0
	3.0	2,200	1	0	0
	0.5	2,400	2	1[b]	1
Armour	12.0	2,000	3	0	0

(continued)

Table 8. Summary of the results of a special survey for Scleroderris canker at 69 locations in the Algonquin Region in 1986 (counts based on the examination of 500+ red pine trees at each location) (continued).

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Minden District					
Minden	9.0	1,600	2	0	0
	9.0	1,700	3	0	0
	7.0	2,200	8	0	0
	4.0	2,100	3	0	0
Somerville	17.0	900	15	0	0
	21.0	1,000	10	0	0
	12.0	1,000	10	0	0
	19.0	900	30	0	0
Galway	8.0	2,200	5	0	0
Snowdon	2.0	1,000	1	0	0
Stanhope	1.0	2,400	3	0	0
Laxton	2.5	2,000	7	0	0
Parry Sound District					
McMurrich	15.0	1,700	2	0	0
	12.0	1,800	3	0	0
	3.0	1,900	5	0	0
	4.0	2,000	1	15[a]	5
	2.5	2,000	5	0	0
	2.5	2,000	18	0	0
Carling	3.0	2,200	7	0	0
Mowat	8.0	2,100	5	0	0
Hagerman	12.0	2,000	5	0	0
Pembroke District					
Brudenell	3.0	1,600	15	0	0
	1.0	2,800	7	0	0
Westmeath	5.0	2,500	20	0	0
	1.0	2,800	2	0	0
	3.0	1,500	9	0	0
	12.0	2,700	2	0	0
Lyndoch	3.9	1,800	15	0	0
	4.8	1,600	20	0	0
Bagot	10.6	1,000	3	0	0

(continued)

Table 8. Summary of the results of a special survey for Scleroderris canker at 69 locations in the Algonquin Region in 1986 (counts based on the examination of 500+ red pine trees at each location) (concluded).

Location (Twp)	Tree ht (m)	Total trees per ha	Total area examined (ha)	Trees affected (%)	Trees dead (%)
Pembroke District (cont'd)					
Gratton	4.3	1,500	2	0	0
Horton	0.5	2,500	15	0	0
	0.5	2,500	5	0	0
Ross	6.0	2,100	7	0	0
	0.5	2,300	5	0	0
	3.0	2,200	4	0	0
Fraser	3.0	2,800	5	0	0
	8.5	2,300	3	0	0
Sebastopol	4.0	2,100	7	0	0
Hagarty	5.0	2,200	6	0	0
Raglan	2.5	2,300	16	0	0
Richards	5.0	2,300	10	0	0
Admaston	3.0	2,900	4.0	0	0
	2.5	1,800	24.0	0	0

[a] Positive identification of the European race of Scleroderris canker

[b] Scleroderris canker identified, serological testing for race identification incomplete

Control programs were conducted by OMNR at the three sites at which the European race was confirmed in 1986. In the Parry Sound District, the 1 ha of 4-m red pine was cut, piled and burned. This plantation was surrounded on two sides by semimature 14-m Scots pine (*Pinus sylvestris* L.), and because Scots pine is a host susceptible to this disease, a buffer zone 12 rows wide was also cut and burned. In the Bancroft District, OMNR cut and burned all infected trees. As a result of the sanitation program conducted this season in Mayo Township, a total of 23.5 ha has now been treated for the disease, 5 ha burned and the remaining 18.5 ha pruned, with the branches left on the ground at the base of the trees.

Tar Spot Needle Cast, *Davisomycella ampla* (J. Davis) Darker

There was an increase this season in the incidence of this needle cast on jack pine (*Pinus banksiana* Lamb.) over the low levels recorded in 1985. The disease was detected in all districts in the region, but the majority of damage was observed in the northeastern portion of the Algonquin Park District and the northern half of the Pembroke District.

Foliar damage ranging as high as 60% was detected in a 12-ha plantation in Richards Township, in scattered 0.5-ha pockets of jack pine in Westmeath Township, and in a 120-ha mixed stand in Rolph Township, Pembroke District. The jack pine sustained 30% foliar damage. A similar damage level was recorded in a 200-ha, 5-m-high open-grown jack pine stand in White Township, Algonquin Park District.

Minor Diseases

Leaf Blight, *Septoria betulae* Pass.

Climatic conditions were favorable for this blight to develop on white birch, (*Betula papyrifera* Marsh.) wherever the host occurred in the region.

Heavily affected trees, with up to 75% of the leaves affected, were found across the entire northern end of the Parry Sound, Bracebridge, Algonquin Park and Pembroke districts. Throughout this area virtually every white birch was severely yellowed by mid-to-late August.

Lower levels of damage ranging from 10 to 50% were commonly observed across the southern half of the southeast corner of the Minden District.

Poplar Leaf Disease, *Linospora tetraspora* G.E. Thompson, *Mycosphaerella populicola* G.E. Thompson, *M. populorum* G.E. Thompson, *Marssonina brunnea* (Ell. & Ev.) Magnus

Heavy defoliation of balsam poplar, (*Populus balsamifera* L.) and, to a lesser degree, trembling aspen, caused by various leaf spots and blights, occurred across the entire region. By late August balsam poplars had sustained as much as 100% defoliation at numerous locations across the southern portion of the Minden and Bancroft districts. Similar damage levels were detected in small pockets of host trees, usually less than 2 ha in size, in the eastern and central portions of the Pembroke District, the northeastern area of the Algonquin Park District, and the northern end of the Parry Sound District.

The leaf spot *Marssonina brunnea* caused heavy discoloration of trembling aspen, virtually across the entire region. It was estimated that 80% of the foliage in the aspen stands were affected. In a 4-ha, 11-m-high hybrid poplar plantation in Ross Township, Pembroke District, 40% of the foliage was affected by this leaf spot.

Table 9. Other forest diseases.

Disease	Host(s)	Remarks
Armillaria mellea (Vahl:Fr.) Kummer Armillaria root rot	rP, wP	2% mortality in a 6-ha plantation of 2-m red pine in Raglan Twp; 1% mortality in an 80-ha red pine plantation in Rolph Twp, Pembroke District; trace levels observed in Somerville Twp, Minden District
Ceratocystis ulmi (Buism.) *C. Morea* Dutch elm disease	wE	Moderate white elm (*Ulmus americana* L.) mortality is still evident along fencerows and creek valleys in Horton Twp, Pembroke District; trace levels are common throughout the range of this host in the region.
Ciborinia whetzelii (Seaver) Seaver Ink Spot of aspen	tA	20% affected foliage in 1-ha pockets scattered along the Achray Rd on the east side of Algonquin Park and on the northeast side of the Pembroke District
Coleosporum asterum (Dietel) Sydow Pine needle rust	rP, jP	A decrease in foliage affected, from a high of 30% in 1985 to 3% in 1986, was recorded in Ross Twp, Pembroke District. On 20% of the trees in a 5-ha plantation in Mayo Twp, Bancroft District, 1% foliar damage occurred.
Cronartium ribicola J.C. Fischer White pine blister rust	wP	There was 5% mortality in a 10-ha portion of a natural mixed stand in Jones Twp; 2% mortality was recorded on scattered natural eastern white pine in a young 5-ha red pine plantation in Stratten Twp, Algonquin Park District.

(continued)

Table 9. Other forest diseases (continued).

Disease	Host(s)	Remarks
Endocronartium harknessii (J.P. Moore) Y. Hirats Western gall rust	rP, jP	trace incidence on red pine in Guthrie Twp, Algonquin Park District
Eutypella parasitica Davidson & Lorenz Eutypella canker	sM	In a mature 20-ha stand in Guilford Twp, Minden District 4% of the trees were affected. In a 10-ha stand in McLean Twp there was 4% damage, and in two similar 15-ha stands in Stisted and Chaffey twps, Bracebridge District, there was 1% damage.
Gnomonia leptostyla (Fr.) Ces. & de Not. Anthracnose	Bu	Up to 100% defoliation was recorded by late August across the Kawartha Lakes area along the southern boundary of the Minden District.
Hypoxylon mammatum (Wahlenb.) J. Miller Hypoxylon canker	tA	There was 10% mortality in a 0.5-ha natural stand in Hagarty Twp, Pembroke District, 25% of the roadside trees were affected in scattered pockets along Hwy 62 in Bangor Twp, Bancroft District, and 5% of the trees were affected in a 1-ha stand in Horton Twp, Pembroke District.
Lophodermium spp. Needle cast	rP	In a 5-ha plantation in Sebastopol Twp, 33% of the 5-year-old red pine were affected, 16% of a similar aged 2-ha plantation were affected in Westmeath Twp, and the incidence rate was less than 1% in a 5-ha, 0.5-m plantation in Horton Twp, Pembroke District.

(continued)

Table 9. Other forest diseases (concluded).

Disease	Host(s)	Remarks
Lophophacidium dooksii Corlett & R. Shoem. Needle Blight	wP	80% of the new needles on scattered 1-ha pockets of mature trees affected in Fitzgerald Twp, Algonquin Park District
Marssonina populi (Lib.) Magnus Marssonina leaf spot	tA	80% affected leaves in scattered stands in Sebastopol Twp, Pembroke District
Venturia macularis (Fr.) E. Müller & v. Arx Shoot blight	tA	5% of the leaders affected in a 1-ha young stand in Horton Twp; trace levels observed in a 6-ha stand in Raglan Twp, Pembroke District

DIEBACKS AND DECLINES

Maple Decline

A special survey was conducted in 10 sugar maple stands in the region (Fig. 9). Six of these stands were previously evaluated as part of the maple decline survey conducted in 1984. At each location a minimum of 100 dominant or codominant trees were examined visually and the current and cumulative dieback in the individual crowns was estimated. The trees were selected randomly by means of a standard evaluation procedure, and although the same stands were evaluated both years, the actual trees evaluated within the stands varied.

The survey indicated that, at first, maple stands did not appear to have had any significant change in vigor since 1984; however, close examination of the individual trees in the stands did show a marked increase in the overall health and vigor of the trees. In the 1984 survey, 94% of the 636 trees evaluated were placed in the first two categories of damage, 9-5% and 6-20% of the current dieback class. Similarly in 1986, 92% of the 1,268 trees evaluated were place din these two categories. However, in 1984 only 53% of the trees were in the first and lowest dieback class, 0-5%, whereas in 1986 this number increased to 84%. The number of trees in the second class, 6-20% decreased from 41% in 1984 to only 15% in 1986. Current mortality levels averaged 2% in the 1984 survey, and 0% this season.

These data are completely summarized and presented in Table 10.

Oak Decline

In 1977, three red oak monitoring plots were established in the region to evaluate crown conditions annually in oak stands. Two plots were located in the Pembroke District, one in each of Alice and Wylie townships, and the third plot was located in Macaulay Township, Bracebridge District. Since 1984 both current and cumulative dieback have been estimated and recorded on each of the 100 trees that have been tagged and numbered on each plot.

The two plots in the Pembroke District have shown very little change in overall vigor and appearance in the past two years. An average of 93% of the trees had only negligible current dieback (5%). In the Bracebridge plot, two additional trees have died since 1985; however, there was a very slight increase in the current and cumulative vigor of the majority of the remaining trees.

The data collected in 1984, 1985 and 1986 are summarized and presented in Table 11.

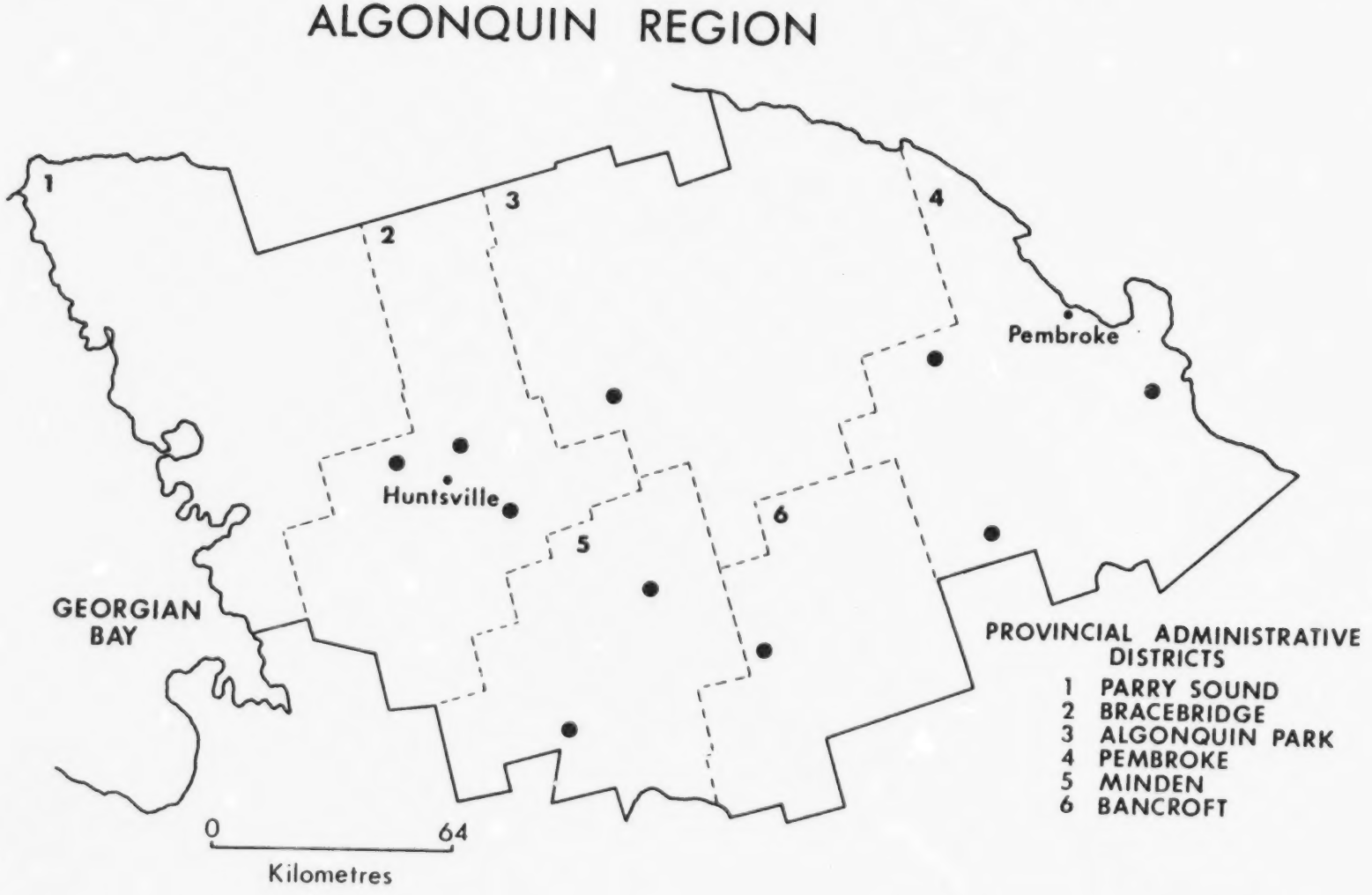


Figure 9. Maple Decline Survey
Locations of sugar maple stands evaluated in 1986.....●

Table 10. Summary of the results of a survey of sugar maple stands conducted at six locations in 1984 and 10 locations in 1986 ir the Algonquin Region.

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Stand size (ha)	Total host trees per ha	Year	Total no. of trees examined	Crown dieback[a] Current (%) 0	1	2	3	4	5	Cumulative (%) 0	1	2	3	4	5
Algonquin Park District																		
Peck	39.7	21	100	180	1984	107	26	61	7	0	0	6	7	37	39	11	0	6
					1986	150	83	15	2	0	0	0	50	44	6	0	0	0
Bancroft District																		
Cardiff	28.3	20	10	210	1984	116	45	51	3	0	0	1	9	44	40	5	0	2
					1986	150	79	18	2	0	0	1	25	61	14	0	0	0
Bracebridge District																		
Chaffey	23.9	19	15	700	1984[b]	–	–	–	–	–	–	–	–	–	–	–	–	–
					1986	103	95	4	1	0	0	0	67	26	7	0	0	0
Stisted	32.2	22	15	600	1984[b]	–	–	–	–	–	–	–	–	–	–	–	–	–
					1986	102	93	7	0	0	0	0	60	32	8	0	0	0
McLean	29.1	20	10	400	1984[b]	–	–	–	–	–	–	–	–	–	–	–	–	–
					1986	106	92	8	0	0	0	0	55	37	8	0	0	0
Minden District																		
Lutterworth	32.8	22	7	100	1984	102	76	22	0	0	1	1	47	44	5	2	1	1
					1986	103	91	9	0	0	0	0	62	34	4	0	0	0
Guilford	21.9	17	20	800	1984[b]	–	–	–	–	–	–	–	–	–	–	–	–	–
					1986	104	95	5	0	0	0	0	63	31	6	0	0	0

(cont'd)

Table 10. Summary of the results of a survey of sugar maple stands conducted at six locations in 1984 and 10 locations in 1986 in the Algonquin Region (concl.).

Location (Twp)	Avg DBH (cm)	Avg ht (m)	Stand size (ha)	Total host trees per ha	Year	Total no. of trees examined	Crown dieback[a]											
							Current (%)						Cumulative (%)					
							0	1	2	3	4	5	0	1	2	3	4	5
Pembroke District																		
Richards	31.1	22	12	150	1984	104	53	38	9	0	0	0	41	42	17	0	0	0
					1986	150	81	19	0	0	0	0	31	49	20	0	0	0
Raglan	33.0	23	12	80	1984	102	76	15	6	0	0	3	53	32	11	2	0	2
					1986	150	70	30	0	0	0	0	31	55	14	0	0	0
Ross	38.9	21	8	180	1984	105	42	57	0	0	0	1	45	53	9	2	0	1
					1986	150	77	23	0	0	0	0	44	49	7	0	0	0

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61%+, 5 = dead tree.

[b] Stand not evaluated in the 1984 maple decline survey.

Table 11. Summary of the results of three semipermanent monitoring plots established in the Algonquin Region in 1977 for red oak decline (data based on the examination of 100 host trees at each location).

Location (Twp)	Avg DBH of sample trees (cm)	Stand size (ha)	Year	Dieback classes											
				Current						Cumulative					
				0	1	2	3	4	5	0	1	2	3	4	5
Bracebridge District															
Macaulay	35	4	1984	69	21	4	0	0	6	2	44	34	11	3	6
			1985	71	17	3	2	1	6	2	39	36	12	5	6
			1986	79	11	0	2	0	8	5	48	32	8	2	8
Pembroke District															
Alice	18	4	1984	51	46	0	0	0	3	0	0	41	54	2	3
			1985	95	1	1	0	0	3	0	0	41	54	2	3
			1986	96	1	0	0	0	3	0	0	42	51	4	3
Wylie	25	3	1984	72	25	0	0	0	3	0	0	27	66	4	3
			1985	93	2	0	0	0	5	0	0	23	69	2	5
			1986	89	6	0	0	0	5	0	0	24	70	1	5

[a] Dieback classification: 0 = 0-5%, 1 = 6-20%, 2 = 21-40%, 3 = 41-60%, 4 = 61%+; 5 = dead tree

ABIOTIC DAMAGE

Frost

Freezing temperatures that caused heavy frost were recorded across the entire region in early May and again in early June. The following temperatures were recorded at the OMNR weather station at the Haliburton Fire Centre in the Minden District: 2 May: -3.0°C, 4 May: -4.0°C, and on 5 May: -1.0°C. The same Centre recorded lows of +2.0°C on the nights of 2 and 3 June.

Trembling aspen was the most commonly affected tree species; often 100% of the leaves showed signs of frost damage. White spruce (*Picea glauca* [Moench] Voss) and balsam fir were estimated to have 60% of the new shoots affected at numerous scattered locations in Mayo Township, Bancroft District, and in Raglan, Lyndoch, Westmeath and Rolph townships, Pembroke District. Damage levels of 30% were recorded in Monmouth Township, Minden District, in Armour and Perry townships, Bracebridge District, and in Sabine Township, Algonquin Park District. In a 1-ha clearcut area in Rolph Township, Pembroke District, open-grown red oak regeneration was found to have 40% of the foliage damaged or killed completely by the frost. Basswood (*Tilia americana* L.), wherever it occurred throughout the region, showed signs of leaf damage in the 5 to 10% range.

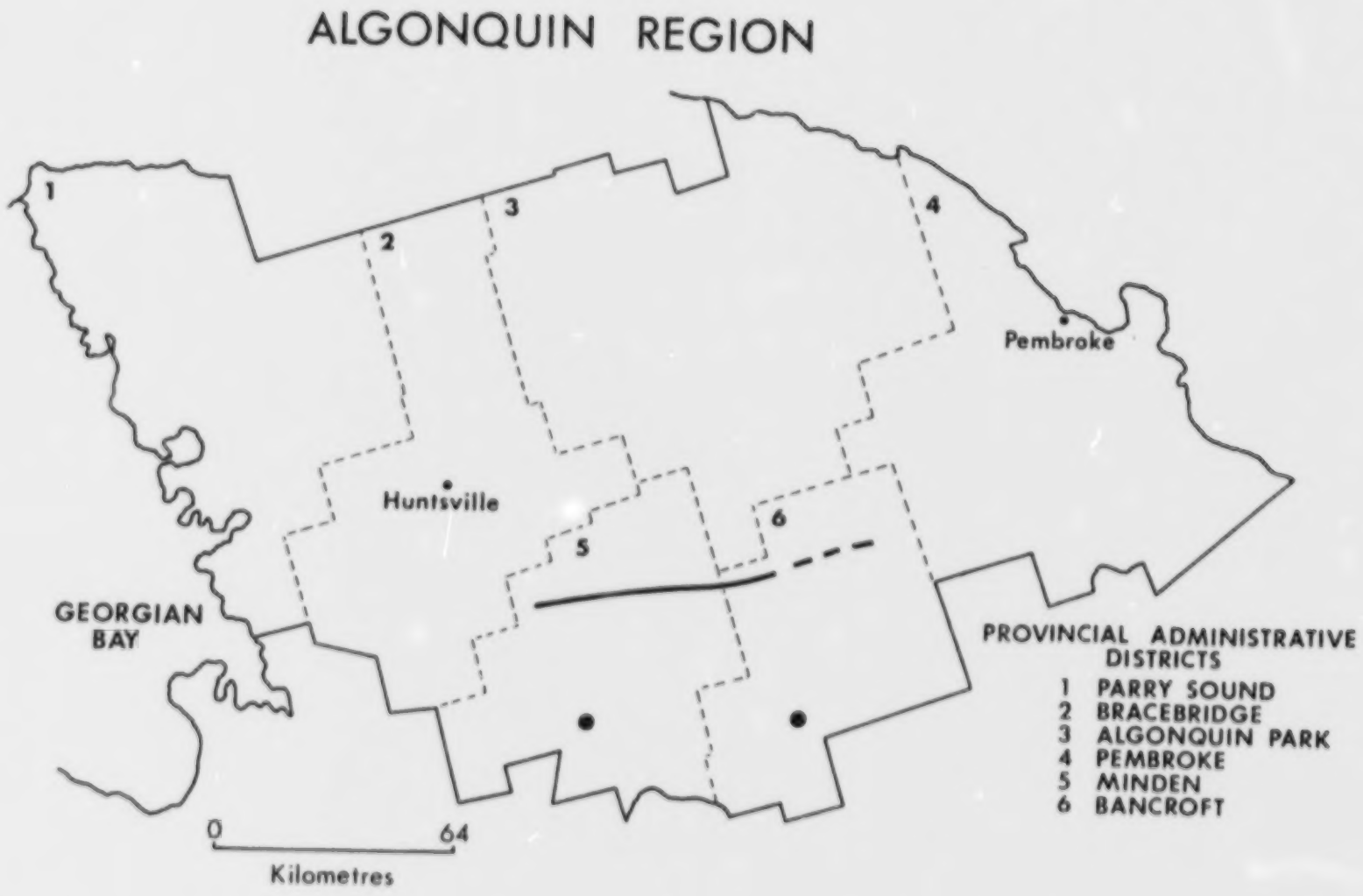
Salt Damage

Again this year, salt damage was very evident along major highways across the work area. The most noticeable damage occurred to young, regenerated eastern white pine along Highway 69 from the French River to the Moon River, Parry Sound District. Similar damage was observed on eastern white and red pine along Highway 11 in the Bracebridge District.

Wind Damage

On 16 June a tornado touched down in the western portion of Hindon Township, Minden District and travelled east for approximately 40 km to the east side of Harcourt Township, Bancroft District (Fig. 10). The tornado then lifted, only to touch down again at several locations across the northern portion of Herschel and Monteagle townships. The actual path of blowdown averaged only 100 to 150 m in width along the entire length of damage.

On the same date, two smaller areas to the south of the path of the tornado sustained wind damage. In the village of Kinmount in Somerville Township, Minden District, approximately 2.5 ha were heavily damaged. Numerous ornamentals were completely uprooted across the northern end of the village.



Forest Insect and Disease Survey
Great Lakes Forestry Centre

Figure 10. Wind Damage

Area within which blowdown occurred in 1986.....—— or ●

In Chandos Township at the southern end of the Bancroft District, approximately 1 km^2 was heavily damaged along Highway 620, west of the hamlet of Glen Alda.

Winter Drying

Foliage discoloration caused by this physiological drought condition was observed across the eastern portion of the region. Foliage was lightly damaged in pockets of stands with southern exposures in predominantly red and eastern white pine plantations and natural stands. Roadside stands with up to 12 affected trees could be found along Highway 17 from Bissett Creek in Maria Township, Algonquin Park District to the town of Pembroke, Pembroke District, and along highways 41, 60 and 62 across the central portion of the Pembroke District.

Winter drying results when a warm spell, usually accompanied by drying winds, occurs after an extended cold period. The needles thaw out and lose moisture, which cannot be replaced by the still-frozen and therefore inactive, root system. When spring comes, the affected foliage is brown and later falls off. The woody tissue of the tree and dormant buds are not usually affected and a normal flush will occur.

SPECIAL SURVEYS

White Pine Plantation Survey

As part of the annual survey of high-value plantations, 10 randomly located white pine plantations were evaluated to determine which forest pests were present and causing damage (Fig. 11). A standard 150-tree evaluation was completed in each plantation, but specific insects and diseases were evaluated. The plantations were visited on two occasions during the year, in early June and again in early August. Table 12 summarizes the data collected on the pests that were present at each location.

During the first visit, white pine blister rust, *Cronartium ribicola* J.C. Fischer, was found present at low levels in seven of the plantations. The pine spittlebug, *Aphrophora cribrata* (Walker), was at seven locations at a very low level, except in Cavendish Township, Minden District, where 30% of the trees were infested with an average of four spittle masses per tree. Pests not found during the first visit were the basal stem canker disease, *Verticicladiella procera* Kendrick, and foliar diseases.

During the second visit, Armillaria root rot, *Armillaria mellea* (Vahl:Fr.) Kummer, was found at a trace level at only one location. The white pine weevil, *Pissodes strobi* (Peck), was found in five plantations, with infested leaders ranging from 2 to 16%. The eastern pine

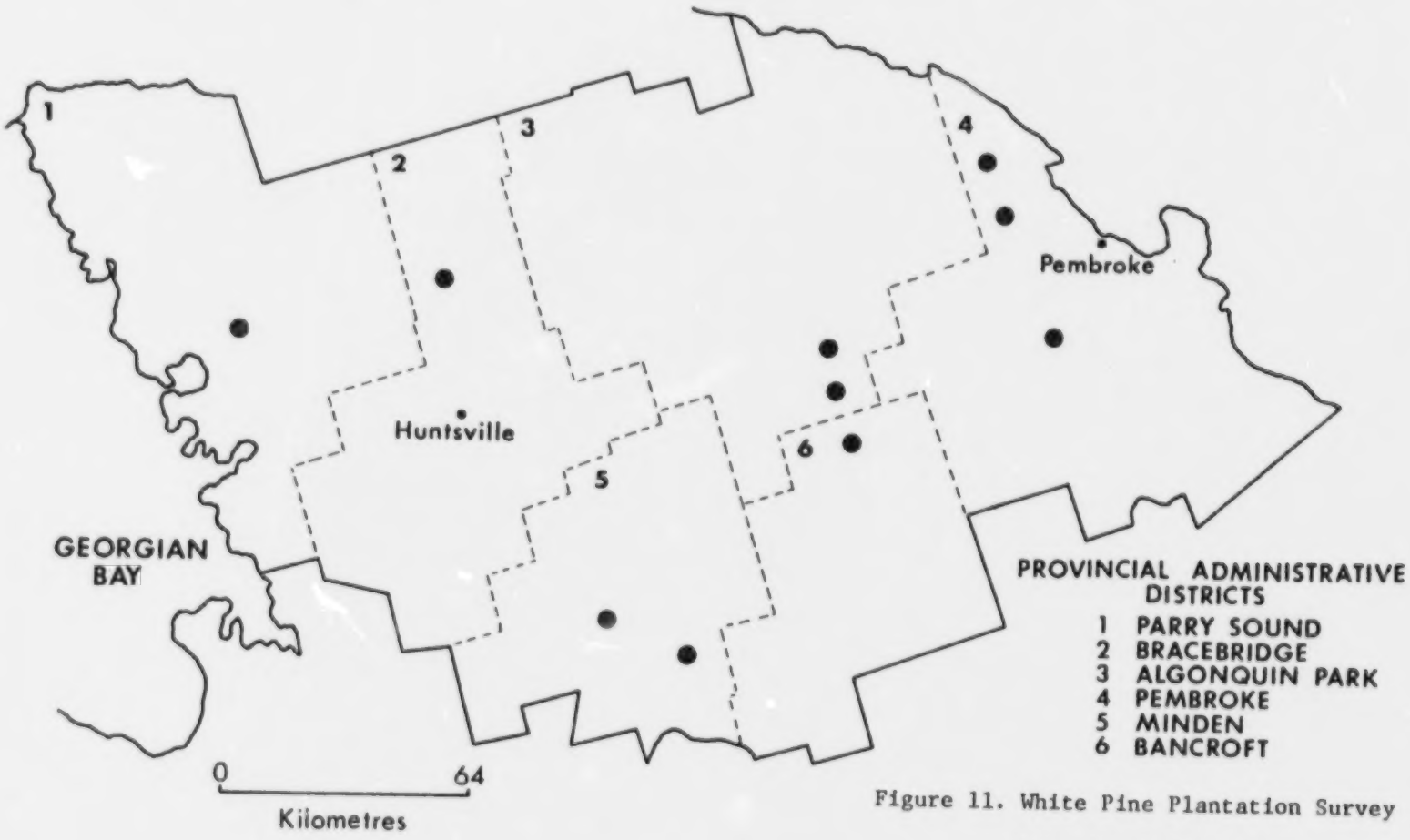


Figure 11. White Pine Plantation Survey

Locations of plantations surveyed..... ●

Table 12. Summary of the results of an eastern white pine plantation survey conducted at 10 randomly selected locations in the Algonquin Region in 1985 (counts based on the examination of 150 trees at each location).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	Pine spittlebug		White pine weevil	Eastern pine shoot borer
				Infested trees (%)	Avg no. of colonies per tree	Infested leaders (%)	Infested leaders (%)
Algonquin Park District							
Murchison	30	700	4.4	2	1	16	0
Lyell	35	1,300	1.8	1	1	8	0
Bancroft District							
Wicklow	3	1,200	1.4	9	2	0	0
Bracebridge District							
Armour	1.5	2,000	0.9	1	1	0	0
Minden District							
Snowdon	2	1,000	1.7	5	1	2	1
Cavendish	3	900	5.7	30	4	9	0
Parry Sound District							
McKellar	2	1,800	5	0	0	5	1
Pembroke District							
North Algona	10	500	34.9	0	0	0	0
McKay	15	1,600	5	3	1	0	0
Wylie	7	800	15	0	0	0	0

(cont'd)

Table 12. Summary of the results of an eastern white pine plantation survey conducted at 10 randomly selected locations in the Algonquin Region in 1985 (counts based on the examination of 150 trees at each location) (concl.).

Location (Twp)	Estimated area of stand (ha)	Estimated no. of trees per ha	Avg ht of trees (m)	White pine blister rust		Armillaria root rot	Current mortality (%)
				Affected trees (%)	Stem cankers (%)	Affected (%)	
Algonquin Park District							
Murchison	30	700	4.4	6	6	1	2
Lyell	35	1,300	1.8	1	0	0	0
Bancroft District							
Wicklow	3	1,200	1.4	4	4	0	0
Bracebridge District							
Armour	1.5	2,000	0.9	1	1	0	1
Minden District							
Snowdon	2	1,000	1.7	0	0	0	2
Cavendish	3	900	5.7	7	2	0	1
Parry Sound District							
McKellar	2	1,800	5	1	1	0	1
Pembroke District							
North Algona	10	500	34.9	0	0	0	0
McKay	15	1,600	5	2	2	0	0
Wylie	7	800	15	0	0	0	0

Table 13. Summary of the results of an eastern white pine cone survey conducted at two locations in the Algonquin Region in 1986 (counts based on the examination of 100 mature cones at each location).

Location (Twp)	Cones damaged (%)	Avg seed counts per sound cone	Avg seed loss per damaged cone	Causal agent in order of importance	No. of agents
Bracebridge District					
Macaulay	23	20	0	White pine coneworm, *Eucosma tocullionana* Heinr.	5
				Jack pine budworm, *Choristoneura pinus pinus* Free.	1
				Cone midge, *Resseliella* spp.	3
				Lepidoptera	1
				Unknown	10
Pembroke District					
Wylie	60	40	22	Cone midge, *Resseliella* spp.	16
				White pine coneworm, *Eucosma tocullionana* Heinr.	15
				White pine cone beetle, *Conophthorus coniperda* Sz.)	5
				Lepidoptera	1
				Unknown	3

shoot borer, *Eucosma gloriola* Heinr., was detected at the trace level in two plantations. No evidence was found of any foliar diseases or the pine bark adelgid, *Pineus strobi* (Htg.).

The special surveys of white pine plantations conducted in 1980 and 1983 showed results very similar, over all, to those of this season's survey. In 1980, foliage diseases were present at six locations, and an average of 26% of the trees were affected; in 1983, white pine blister rust was found at only one location.

White Pine Cone Survey

A special survey was conducted at two locations in the region to determine the various pests affecting white pine cones. Natural stands of semimature trees were selected in Macaulay Township, Bracebridge District, and in Wylie Township, Pembroke District. At each location, 100 semimature, green, succulent cones close to full size and in their second year of development were sampled. The cones were randomly selected from the total length of the cone-bearing crown.

Damage to cones amounted to 60% in the Pembroke District, and was caused mainly by cone midge, *Resseliella* sp. In the Bracebridge District damage amounted to 23%, and was caused mainly by white pine coneworm, *Eucosma tocullionana* Heinr. (see Table 13). A similar survey was conducted in 1983, when 56% of the cones were affected by *E. tocullionana* Heinr., in comparison with 15% in 1986.

Light Trap

Again this year a light trap was operated at the Petawawa National Forestry Institute (PNFI) at Chalk River in the Pembroke District. The primary purpose of operating the light trap is to monitor the flight period and population levels of the adult spruce budworm moth.

A light trap can be used to indicate that populations are present in an area and to determine when they are active. The total numbers trapped each year indicate changes in population levels.

The light trap was operated every night from 20 June to 1 August. The first spruce budworm moth was collected on 22 June. The peak of the moth flight occurred over a period of six nights from 4 July to 9 July, with 341 adults being captured. Only three moths were trapped during the remainder of the trapping period (Table 14).

The results of trapping also indicated that there has been a steady increase in the population levels of the forest tent caterpillar.

Table 13. Summary of the results of an eastern white pine cone survey conducted at two locations in the Algonquin Region in 1986 (counts based on the examination of 100 mature cones at each location).

Location (Twp)	Cones damaged (%)	Avg seed counts per sound cone	Avg seed loss per damaged cone	Causal agent in order of importance	No. of agents
Bracebridge District					
Macaulay	23	20	0	White pine coneworm, *Eucosma tocullionana* Heinr.	5
				Jack pine budworm, *Choristoneura pinus pinus* Free.	1
				Cone midge, *Resseliella* spp.	3
				Lepidoptera	1
				Unknown	10
Pembroke District					
Wylie	60	40	22	Cone midge, *Resseliella* spp.	16
				White pine coneworm, *Eucosma tocullionana* Heinr.	15
				White pine cone beetle, *Conophthorus coniperda* Sz.)	5
				Lepidoptera	1
				Unknown	3

Table 14. Summary of the results of the light trapping program at PNFI for spruce budworm and forest tent caterpillar, 1983 to 1986.

Year	Spruce budworm	Forest tent caterpillar
1983	2,360	168
1984	183	331
1985	14	557
1986	344	779

Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

In the continuing program to establish if the pinewood nematode is present in the Algonquin Region, an additional 13 locations were sampled this season (Fig. 12). This brings the regional total to 48 stands that have been samples, 42 of them proving negative. In only one of the remaining six areas sampled has the nematode been positively identified. It was recovered in 1985 from a dead red pine at the Canadian Forces Base at Petawawa in Buchanan Township, Pembroke District. This season, nematodes were present in the samples at five locations; however, the species or form has yet to be identified.

Acid Rain National Early Warning System (ARNEWS)

In 1986, an additional ARNEWS plot was located and established in the region, bringing the total to six plots. The new plot was located in the southwest corner of Sproule Township, Algonquin Park District (Fig. 13).

In the Parry Sound District, the plot was located in an immature stand of white birch, red maple and trembling aspen. The Bracebridge District plot consists of mature sugar maple and yellow birch (*Betula alleghaniensis* Britton); the Minden District plot is in a mature sugar maple and eastern white pine stand; the Algonquin Park District plot is a pure stand of semimature red oak, and the two Pembroke District plots are in plantations of immature white spruce and Norway spruce (*Picea abies* [L.] Karst.).

This season all plot trees were evaluated for overall tree vigor, crown condition, current defoliation by any type of forest pest, acid rain symptoms and woody tissue damage by forest pests. The three regeneration subplots at each plot were retallied and the established list of ground plants present on each site was reviewed for any change in the type of plants occurring there.

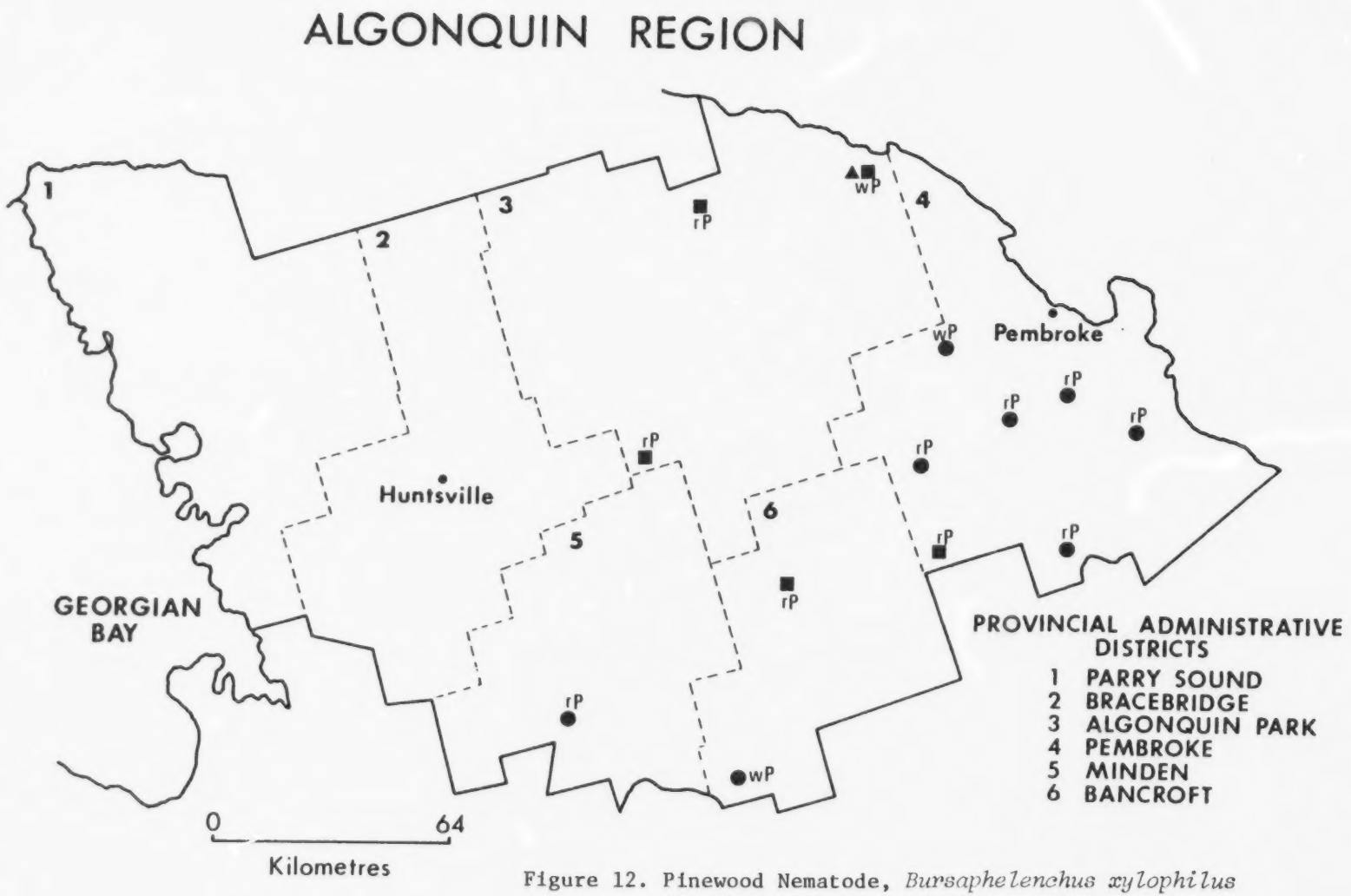


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Figure 12. Pinewood Nematode, *Bursaphelenchus xylophilus* (Steiner & Buhrer) Nickle

Locations at which nematode samples were collected: species and form yet to be identified.....■

Additional locations sampled for pinewood nematode in 1986..●

Samples collected on *Monochamus* spp. adult beetle.....▲

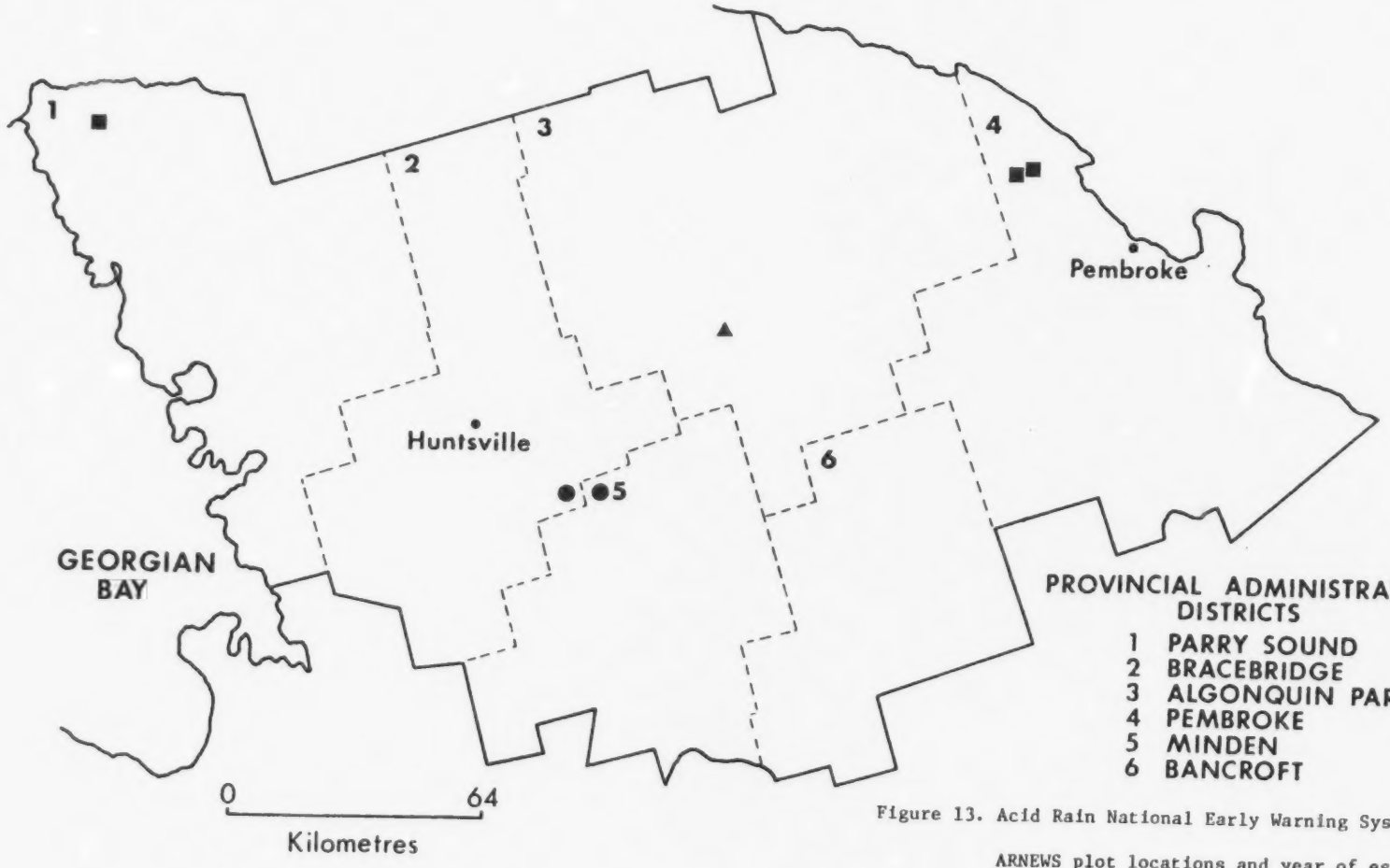

Figure 13. Acid Rain National Early Warning System (ARNEWS)

ARNEWS plot locations and year of establishment:
1984.....●
1985.....■
1986.....▲

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No serious pest problem was encountered on any of the plots and no damage or discoloration of foliage that could be attributed to acid rain was detected.

Climatic Data

Seasonal variations in the normal weather patterns have a direct effect on both biotic and abiotic conditions. Sudden and extreme changes in weather have historically had a significant impact on pest problems; in particular, they have played a role in controlling insect outbreaks. Monitoring of daily weather conditions permits accurate prediction of the emergence of overwintering larvae or the onset of drought conditions. For these reasons, the Forest Insect and Disease Survey Unit keeps daily and monthly averages of weather conditions on file for numerous locations across the province. Table 15 summarizes the weather data for 1986 (January to December). The information was provided by two Atmospheric Environment Service weather offices in the Algonquin Region. The normals quoted were taken directly from the Canadian Climate Normals for Ontario, 1951-1980.

Table 15. Summary of climatic data covering the 12-month period, January to December 1986, from two locations in the Algonquin Region.

Location	Month	Mean temperature		Total precipitation	
		Actual (°C)	Normal (°C)	Actual (mm)	Normal (mm)
Bracebridge District					
Muskoka Airport	Jan.	-10.9	-10.4	64.1	85.9
	Feb.	-10.1	- 9.4	35.8	62.4
	Mar.	- 2.4	- 3.8	104.8	66.3
	Apr.	+ 7.5	+ 4.5	69.3	73.3
	May	+13.3	+10.9	102.8	77.8
	June	+14.2	+15.9	127.2	81.9
	July	+24.4	+18.3	103.7	77.5
	Aug.	+15.8	+17.4	96.0	89.0
	Sept.	+12.2	+13.2	174.7	102.4
	Oct.	+ 6.6	+ 7.5	103.5	93.9
	Nov.	- 1.0	- 1.1	63.7	101.0
	Dec.	- 4.4	- 7.1	112.5	97.8
Pembroke District					
Petawawa Weather Station	Jan.	-12.5	-12.8	44.5	46.7
	Feb.	-11.6	-11.2	26.3	51.0
	Mar.	- 3.0	- 4.6	59.1	50.5
	Apr.	+ 7.3	+ 4.2	56.4	59.6
	May	+13.6	+11.5	143.4	60.0
	June	+14.6	+16.3	103.5	87.5
	July	+18.6	+18.7	65.9	84.5
	Aug.	+16.2	+17.6	88.4	79.8
	Sept.	+11.4	+12.6	87.6	83.1
	Oct.	+ 5.7	+ 7.1	49.6	66.7
	Nov.	- 1.7	- 0.1	32.3	65.8
	Dec.	- 6.6	- 9.7	80.0	64.8